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THE MANUFACTURE OF COVERED BUTTONS.

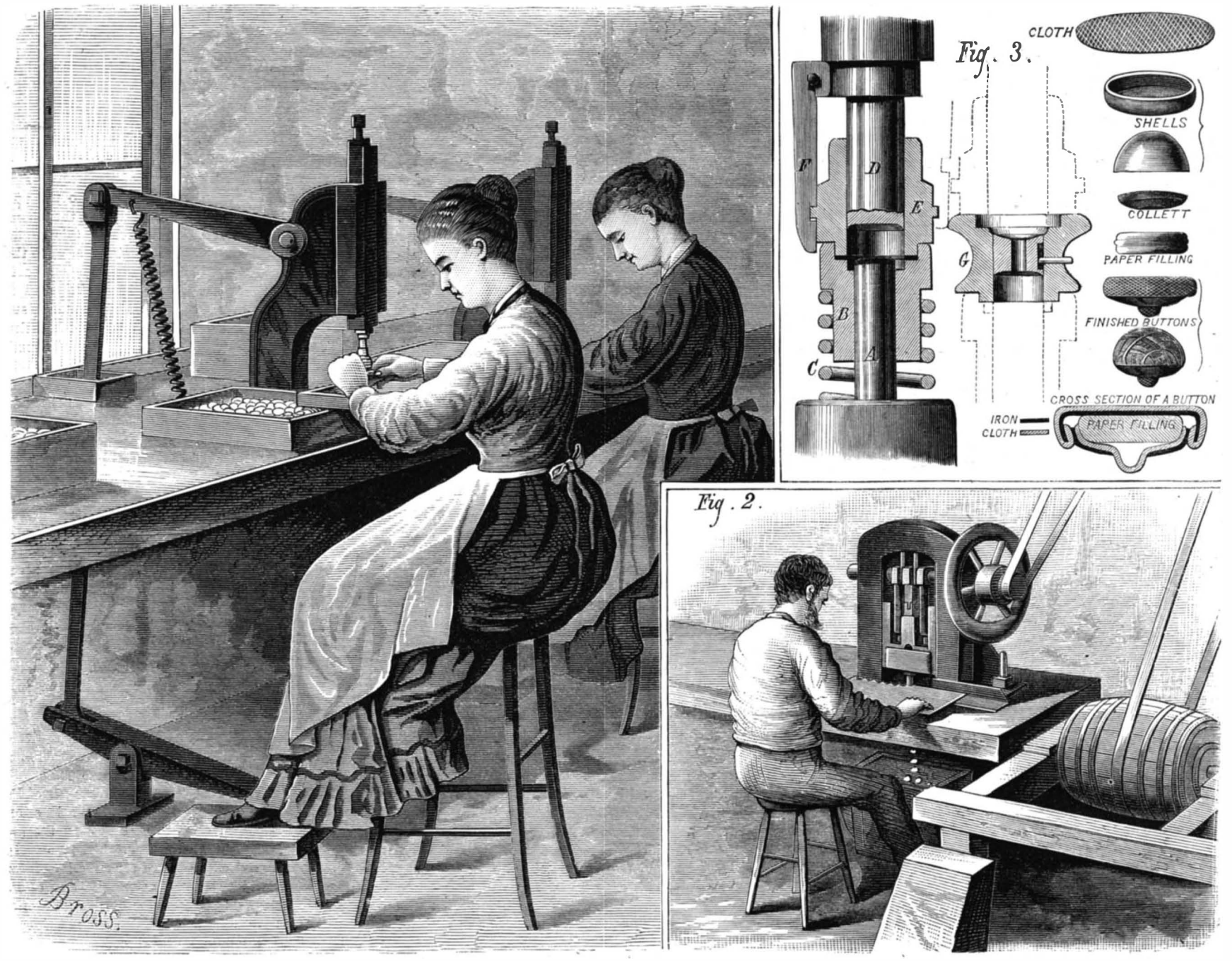
There is nothing particular intricate in the construction of a button, one of the ordinary cloth-covered type for instance, such as is on everybody's coat, to suggest the idea that the manufacture involves any very extensive preparation. But on the other hand, when it is remembered that every one wears buttons, that every man has perhaps a dozen or two constantly about him, and every woman, now that Dame Fashion has decreed that a multiplicity of buttons is an appropriate ornament, displays as many dozen as she conveniently can, it will be seen that the button must be the basis of a great industry. Besides, buttons are like pins, millions are made and nearly all containing in some portion metal which is virtually indestructible, and yet they disappear and no one knows whither. No wonder, then, that the factories at Waterbury, Conn., and Easthampton, Mass., alone produce buttons to the value of over $250,000 a year, and that according to the last census the annual product of all the button-making establishments in the country is valued at nearly $2,000,000.

We shall reserve the consideration of metal buttons to some other occasion, when an opportunity offers to enter into the details of the machinery used. For the present we propose to examine the commonest button of all, the cloth-covered object which the reader, if so disposed, may cut from an old coat and proceed to dissect while he reads the following description of its anatomy. After removing the outer epidermis of cloth, he will encounter the skeleton or metal shell; this off, the inner viscera or paper filling, and beneath that the tuft piece of cloth, are exposed, and last of all is the metal collet or under ring. Any one disposed to class the button zöologically may refer it to the turtle family of *trionychidæ*, "body enclosed between two or more or less shields, which are usually covered by a leathery skin. The carapace (upper shield) and plastron (lower shield) are more or less united along the sides." The construction of the button being thus understood—and to make it clearer we have engraved the parts dissected, as well as joined together, in Fig. 3—it remains to explain the ingenious way in which it is produced.

The first covered buttons were made on wooden moulds turned of wood in the lathe, the cloth being simply stretched over and sewed on the back. This is the home-made fashion of making buttons now, as our fair readers are abundantly well aware; but it is altogether too slow a process for the manufacture of the millions of buttons required for commerce, not to mention the fact that the finished work is unnecessarily clumsy. With the introduction of button-making machinery wooden moulds departed and iron shells took their place. Thin sheets of metal, known as "tagger's iron" (thickness No. 36 to No. 38, and quality according to the more or less fine grade of button to be made), are carried by hand rapidly under a descending punch, Fig. 2. This punch is double, the outer portion cutting out a circular blank of the proper size, while an inner punch descends and forces the blank into a die, so that its periphery is turned upward, or so that the entire blank is rendered hemispherical in shape. These two forms of shells are shown in Fig. 3. One machine, driven by steam power, will easily form 50 gross of shells per hour.

The shells are next annealed in an ordinary furnace, and then are conveyed to a horizontal revolving barrel, Fig. 2, where they are tumbled with sawdust until they are thoroughly cleaned from all dust and grease. The other part of the skeleton of the button is known as the collet. Inasmuch as the under side of this is exposed, one face of the iron plate is japanned. The piece, by a somewhat similar arrangement of punches to that already described, is first cut out in the form of a circle and then its inner part is punched out, leaving it in annular shape. There are still three more portions, namely, the cloth cover, the canvas tuft piece, which rests above the collet, and a portion of which protrudes through the central opening in the latter to furnish a tuft by which the button is sewed on the garment, and the inner filling. The last is made of specially prepared pasteboard, and in common with the other portions mentioned is simply punched into shape.

The grouping together of these various parts is effected in two operations. By the first, the collet and tuft piece are fastened. The tuft piece is laid in the collet under a press, which, descending, forces the fabric, as already stated, through the aperture in the metal, producing the nipple of cloth in the rear. The paper filling is then inserted, and the button is then ready for the final assembling. The machine for this purpose is represented in Fig. 1, and the details of its press in Fig. 3. A is a fixed mandrel. B is a sleeve thereon, supported by a spring, C. On the upper mandrel, D, is another sleeve, E, which is sustained by the catch, F. The lower face of the mandrel, D, is hollowed, and a projecting annular portion of the upper sleeve enters a corresponding portion of the lower one, E. In using the machine a shell is placed over the lower mandrel, and above it is laid the covering fabric. The operator then causes the upper mandrel to descend. The cloth is thus pressed down around the shell, and on the return upward movement both cloth and shell are carried up inside the sleeve, E. The operator now inserts the annular piece, G, in which there is a suitable cavity to receive the combined collet, tuft piece, and filler, the last being uppermost. The upper mandrel is again brought



THE MANUFACTURE OF COVERED BUTTONS.

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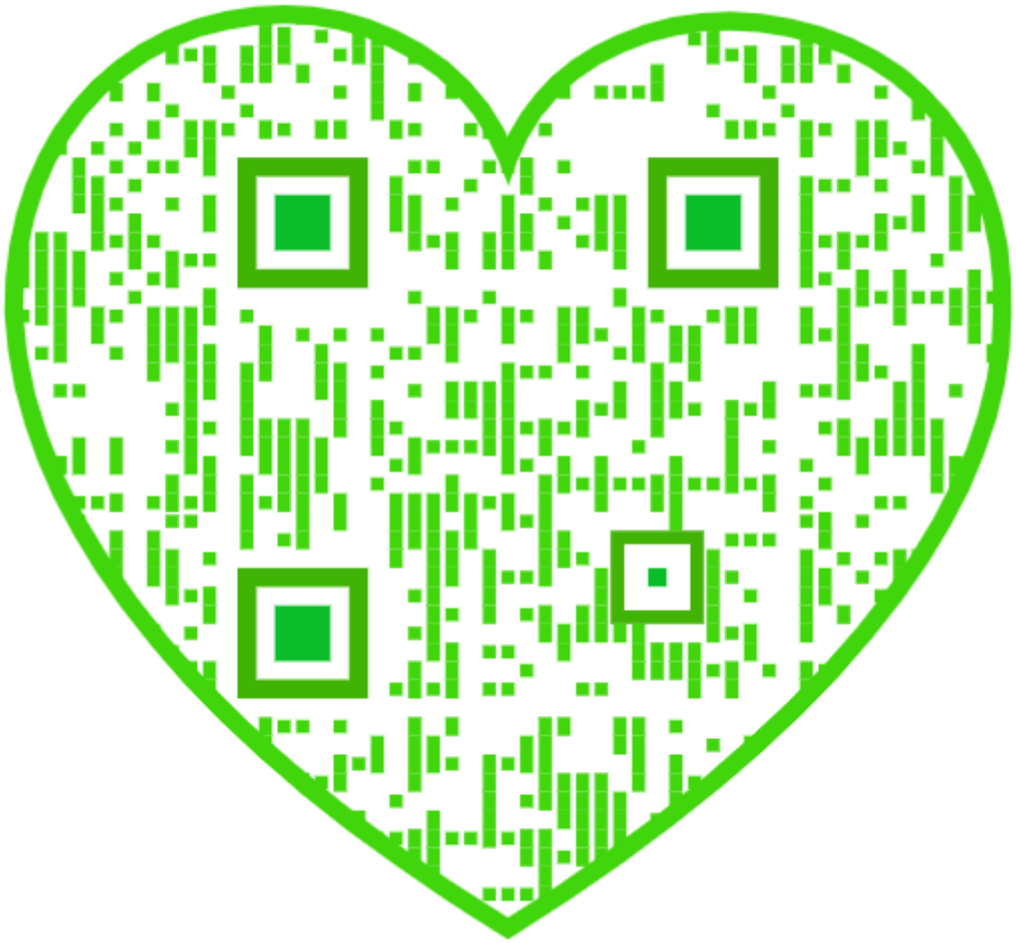

down and the shell is thus forced upon the collet, filler, etc., the cloth cover being at the same time turned under. Reference to the section of the finished button in Fig. 3 will make this clear. Nothing further remains but to attach the buttons by dozens to cards, or make them up for the market in any desired attractive way.

There is another variety of button belonging to the same class as the above, but termed "silk back" in contradistinction to "iron back." The face consists of shell and cover, while the back is composed of four layers, namely, a concave circular piece of tagger's iron, somewhat smaller than the shell, a pasteboard blank, a canvas blank, and, lastly, a silk back. These are put together in manner similar to that already described, and then by means of a press a nipple for purposes of attachment is formed on the back.

The City Button Works, of 116 Walker Street, this city, have courteously offered us the facilities for preparing the foregoing description and engravings.

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THIERS AND CONTEMPORARY SCIENCE IN FRANCE.

To have it said that the period of his life marks an epoch in the history of his country, is perhaps as high fame as any man can hope to attain. Such, however, will be posterity's verdict in recording the biography of Louis Adolph Thiers. Born on April 16, 1797, of humble parentage, the lapse of the first twenty-five years of his life found him not merely unknown, but struggling for bare existence. His abilities, it is true, had shown themselves in literary contests, but his political proclivities, at a time when such opinions overshadowed all else, barred his advancement. The period of his progress dates from his entrance into journalism. From the editor's chair he passed to that of the historian; from the historian to the statesman is but a step, and on the accession of Louis Philippe, he became a cabinet minister. With his political life thence forward, which culminated in his being chosen President of the French Republic in 1871, it is not our province to deal.

The interval of eighty years (ending on the 30th of the present month), over which M. Thiers' existence has extended, will be remembered in the history of the French people, not alone as one of unexampled political changes. Despite the instability of governments, and in marked contrast therewith, the march of science in France has continued onward as unswervingly as in other countries the internal peace of which scarcely has been broken; and to contemporaries of the great statesman now deceased, with whose labors he was in full accord, whose friend, associate, and upholder he was, is owing the present leading place which France now holds among scientific nations. To recall the names of these men and their work is to review some of the grandest achievements in human progress. It brings before us Arago's magnificent investigations in magnetism and the polarization of light. Becquerel the elder's discovery of the relation between electricity and chemical affinity; that first step made by Becquerel the younger toward color photography; the demonstration of the influence of light on chloride of silver in the daguerreotype; the labors of Daguerre and the Niepces de St. Victor (of the last name, father and son), which, as all the world knows, resulted in the art of photography; Berthelot's discovery of acetylene and synthesis of alcohol; Balard's extraction of bromine from sea water; besides the splendid chemical work of Thénard, Despretz, Cagniard de la Tour, Berthollet, Pélouze, and Dumas. France still possesses Pasteur, first of living biologists and the uncompromising opponent of the spontaneous generation theory. The past labors of her modern physicists have included those of Gay Lussac, whose investigations extended over the whole field of science, but whose discoveries in the properties of air and other gases are of inestimable importance. In the same field belongs the work of Dulong, discoverer of the most violent of explosives, chloride of nitrogen, of Petit, and of Regnault. In Leverrier, discoverer of Neptune, and weigher of other worlds, France possesses the greatest of contemporary astronomers. In Cuvier and Geoffry St. Hilaire, the one the founder of the science of comparative anatomy, the other his no less able opponent and critic, she possessed naturalists whose fame can never be diminished. Such were a few of the men of science who have had in Thiers a friend who despite the engrossing activity of a turbulent political career, found time to master the results of their labors and to enrich therewith his already vast store of almost encyclopædic knowledge.

Throughout all Thiers' history—although it does not appear that he was himself intimately connected with scientific men—there can be traced the consequences of his association with scientific men, and his substantial appreciation of their merits. When he became Minister of Commerce and Public Works in 1832, procuring a grant of twenty million dollars, he carried out a system of internal improvements, which have been to France of incalculable benefit, while at the same time he encouraged national industries in a manner that infused new life into their every department. In 1833 he was elected to the French Academy, and soon after he became a member of the Academy of Moral and Political Science.

Although Thiers was not a scientist in one acceptation of the term, yet in the widest sense he merited the title in the highest degree. There is no science grander and nobler than the science of governing—the science of leading and directing others so as to secure the most good for all—and in that science Thiers stood preëminent.

SARGENT'S CASE.

Some very interesting and novel questions in relation to interference controversies, and of great importance to inventors, have lately arisen before the Patent Office, in the case of James Sargent.

This gentleman, in February, 1874, filed an application for a patent for an improvement in time-locks; but this application being defective, he withdrew the same, and, on the 12th of March, 1875, substituted for it a new application. Three days later, Emory Stockwell, assignor to the Yale Lock Manufacturing Company, filed, on behalf of said company, an interfering application. The interference thereupon declared was decided by the Examiner of Interferences in favor of Sargent, and from this decision no appeal was taken.

On the 2d day of June, 1875, John Burge, assignor to the said Yale Lock Manufacturing Company, filed on behalf of said company, an interfering application. An interference was accordingly declared between said applications, and a large amount of testimony was taken on both sides. The decision of the Examiner of Interferences was again in favor of Sargent. From this decision the unsuccessful party appealed to the Board of Examiners-in-Chief, who affirmed the decision of the Examiner below; and from this decision an appeal was taken to the Commissioner of Patents in person. In April, 1876, the Commissioner rendered his decision, affirming those of the Examiner of Interferences and of the Board of Examiners-in-Chief, in favor of Sargent.

Interfering applications with Sargent's were also filed by Pillard, August 13, 1875; by Lillie, April 28, 1876; and by Little, June 6, 1876. In all of these three last mentioned cases, the Examiner of Interferences decided the question of priority of invention in favor of Sargent. Pillard and Lillie did not appeal. Little appealed successively to the Board of Examiners-in-Chief and the Commissioner of Patents in person, and on both appeals the question of priority of invention was decided in favor of Sargent. The decision of the Commissioner in this last named case was rendered on the 9th day of July last, after which, every pending interference with Sargent's application having been finally disposed of, Sargent paid the final government fee, and demanded the issue of a patent.

Meanwhile, on the 4th day of June, 1877, John Burge, before mentioned, had commenced a suit in equity in the Supreme Court of the District of Columbia, under section 4,915 of the Revised Statutes, against Sargent, praying to be adjudged to be entitled to a patent for the invention which had been the subject-matter of his interference with Sargent, and praying also for an injunction restraining Sargent from taking out the patent until the determination of said equity suit. Immediately after the decision of the Commissioner in Little's case, a motion was made on behalf of Burge, before the Commissioner of Patents, *to suspend* the issue of a patent to Sargent until the determination of said equity suit.

This motion was fully and ably argued before the Commissioner. On the part of Burge, it was insisted that so long as a party to an interference was pursuing such remedies as were secured to him by express statutory enactment, his adversary should not be permitted to obtain, by the issuance of a patent, *prima facie* title to the very matter concerning which the entire interference controversy had been made; in other words, that the corpus of the litigation should be preserved throughout until the dissatisfied party had exhausted all his just legal remedies, or until, by his inaction, a conclusive presumption of abandonment of the contest should arise against him.

Sargent maintained, in opposition to this view, that, when a final judgment and award of priority is made by the Commissioner, the right of the successful party to an immediate grant of letters patent against his opponent is complete, and that this right could not be affected by the result, whatever it might be, of the equity suit.

The Commissioner rendered his decision upon this motion on the 24th of July last. He held that power was vested in him by section 4,904 of the Revised Statutes, to withhold the issue of a patent to a successful interference contestant, after final award in his favor by the highest tribunal within the Office, pending the result of an equity suit brought by his opponent; and that the occurrence of the word "may" in the phrase of such section, "*may* issue to the party adjudged the prior inventor," instead of the mandatory "shall," was not without significance in this connection, and reposed a discretion in the Commissioner as to the issue of the patent. He therefore suspended the application of Sargent pending the result of the equity suit.

From this order of the Commissioner of Patents, suspending the issue of letters patent, Sargent, on the 30th day of July last, presented his petitions in the form of a motion for the revocation of the order, to the Hon. Carl Schurz, Secretary of the Interior.

Sargent's counsel insists in the first place, that under this order of the Commissioner, Sargent suffers a very grave injury. That owing to the voluminous testimony to be taken, the equity suit cannot reasonably be expected to be carried through the Supreme Court of the District of Columbia in less than two years, and that if an appeal be taken to the Supreme Court of the United States, three more years will be consumed, and that thus Mr. Sargent's patent is liable to be suspended for at least five years longer, and that in the meantime the demand for time-locks will have become so fully supplied that his patent will be of little or no value.

They urge, in the second place, that the Secretary of the Interior has power to redress this injury. This argument rests mainly on three sections of the Revised Statutes.

Section 441 declares that "the Secretary of the Interior is charged with the supervision of the public business relating to the following subjects;" the fifth of which, in numerical order, is "Patents for Inventions." This, Sargent's counsel claims, makes it one of the primary duties of the Secretary of the Interior to oversee and give orders how and where patents for inventions shall be delivered.

Section 481 provides that "the Commissioner of Patents, under the direction of the Secretary of the Interior, shall superintend or perform all duties respecting the granting and issuing of patents directed by law." This, counsel argue, imports the order and command of the superior officer.

Section 483 provides that "the Commissioner of Patents, subject to the approval of the Secretary of the Interior, may from time to time establish regulations not inconsistent with law, for the conduct of proceedings in the Patent Office."

That the order in question amounts to nothing more or

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less than a "regulation," Sargent insists is manifest from the fact that it does not assume to decide any question of *right*, but merely relates to a matter of purely executive or administrative practice. That it is an order which must be made in every case where a defeated party in an interference files a bill in equity under said Section 4,915, for in this case not a single fact was even alleged in support of the motion, except the naked fact of the filing of the bill. It therefore amounts, in the strictest sense, to a rule or regulation applicable to all similar cases, and it therefore becomes the duty of the Secretary of the Interior, when his attention is called to it, either to approve or disapprove and annul it. This in brief is the argument of Sargent's counsel.

As the practice of the Patent Office has heretofore been to allow the successful contestant his patent immediately upon a final determination of the interference, the action of the Secretary of the Interior upon the order of the Commissioner will be awaited with great interest.

NEW PROCESS FOR ELECTRO-PLATING.

Professor A. W. Wright, of Yale College, New Haven, Conn., has discovered a new and brilliant method of electro-plating, which promises to be of great utility. Taking advantage of the fact that the various metals may be volatilized by the electrical current, he provides a hollow vessel, from which the air is partially exhausted; within this vessel he arranges opposite to each other the two poles of an induction coil; the article to be electro-plated, a bit of glass for example, is suspended between the poles; to the negative pole is attached a small piece of the metal that is to be deposited on the glass. From three to six pint Grove cells are employed, yielding, by means of the induction coil, an electrical spark from two to three inches in length. Under the influence of this spark a portion of the metal of the electrode is converted into gas or volatilized, and condenses upon the cooler surface of the suspended glass, forming a most brilliant and uniform deposit. The thickness of the plating thus produced may be regulated at will, by simply continuing the action of the electricity for a longer or shorter period. That the metal is actually volatilized is proven by examination with the spectroscope during the progress of the operation, the characteristic lines of whatever metal is used for the electrode being fully revealed. This may be classed as the discovery of a new art, and is certainly very interesting and remarkable. In brief, it consists in plating the surfaces of substances with metals, by exposing such surfaces to the hot vapors of whatever metal it is desired to plate with.

Professor Wright has already made a number of valuable practical applications of his discovery. He produces mirrors with silver, platinum, iron, and other metals, of the most pure and resplendent character. He deposits gold in a layer so thin that it is only 0·000183 mm. in thickness, or approximately only one fourth the wave length of a red ray of light. He obtains curious colors in the metals, varying with the thickness of the deposits, and opens up a new field for investigation into the nature of metals and other volatilizable substances, and perhaps of light. He shows that his electrically deposited metals have improved qualities; that telescopic and heliostatic mirrors, for example, of platinum deposited on silver, by his process, will be unalterable; and the promise is that we shall before long be able by this new art to produce telescopes and other scientific instruments of greatly improved character.

THE ELECTRO-SILICIC LIGHT.

M. Gaston Planté has recently called attention to the brilliant luminous effects obtained by causing one of the poles of a powerful secondary battery to touch the side of a glass vessel or porcelain vase containing a saline solution. In another experiment, by means of which he exhibited the aspiration produced by the electric current around a platinum wire traversing a capillary tube, it was also observed that, if the current exceeded a certain intensity, the limit of which depends on the nature of the saline solution used, the glass then fuses, even in the liquid, and gives forth a bright light. The extremity of the platinum wire, which is made in ball-shape, becomes enveloped in a mass of melted glass, and the light is maintained brilliant during the discharge of the secondary battery, until the glass, cooling around the electrode, completely isolates it from the liquid.

When a solution of rock salt is used in the voltameter, this luminous effect requires for its production the reunion of from 250 to 300 secondary couples; but if a nitrate of potash solution is employed, the light is obtained with 60 secondary couples, the intensity of which correspond nearly to that of 90 Bunsen couples. The manner in which saline solutions act, in connection with glass silex brought to a high temperature by the electric current, is varied, because of the greater or less degree of fusibility of the silicates formed, as M. Carré has noted, by combining various salts with the carbons used for the ordinary electric light. The vitreous light may be produced either at the positive electrode or at the negative one, placed successively in contact with a tube or glass surface. A greater energy is required for its manifestation at the positive pole; but it is there less noisy than at the negative electrode, where it is attended by notable crepitation. At the moment when the light appears, a thick and abundant white vapor is disengaged, which gives a light alkaline reaction. At the same time the glass is strongly attacked and devitrified.

The brilliancy of the light may at first be attributed to the lime combined with the silex in the glass; but if the spectrum be examined, it will be seen to present few appreciable rays, except some traces of those of sodium. On the other hand, a fragment of calcareous spath placed in the same conditions, while also giving a very brilliant light, has a continuous spectrum which shows the characteristic rays of calcium.

In both cases the spark, formed at the negative pole above the nitrate of potash solution goes, gives, before the contact of the electrode with the glass or spath, the potassium lines; but these lines disappear as soon as the most brilliant light from either glass or spath is produced. The silicium lines, according to M. Kirchoff's investigations, being faint, it is evident that they do not appear because of the luminous intensity of the spectrum formed, just as the carbon lines are not perceptible in the spectrum of the incandescent carbons of the voltaic are.

The silicic origin of this light is also proved by the fact that it is manifested on contact of the electrode with pure silex in the state of crystals of hyaline quartz. In this case, however, about 100 secondary couples are necessary for its production. As the silex itself may be decomposed by currents of great tension, the luminous effect probably, says M. Planté, results from the incandescence of the silicium, between which and diamond and graphite, MM. Déville and Woehler have shown remarkable analogies to exist. In order to distinguish the light from that produced between the carbon points, M. Planté designates it as the electro-silicic light.

PROGRESS OF HARDENED GLASS MAKING.

About two years ago M. Royer de la Bastie produced his tempered glass. It will be remembered that the Bastie process consists in heating the glass object to a red heat in a furnace, and plunging it while in this state into a cooling bath. This method, in common with some others of later date, and based on the same principle, requires that the object shall be completely formed before the hardening operation, and this, besides producing other disadvantages, tends to enhance the cost of manufacture. The glass, when heated to the necessary temperature, becomes so softened that it is almost impossible to transport the object from furnace to bath without some deformation taking place, and to this cause are due the irregularities so often noticeable in tempered glass articles, and notably the departure of window panes from a true plane. There are other disadvantages due to the bath, which is composed of oil or other greasy material heated to a temperature varying between 392° and 572° Fah., according to the quality of glass to be tempered. When the red hot article is plunged in, the oil easily takes fire. This can, of course, be avoided by proper precaution, but it is obviously a source of danger. There are, besides, the disagreeable odor arising from the bath, the large expenditure of oil, which decomposes on contact with the hot glass, and finally the fact that each special composition of glass requires a different temperature of the bath, and it is very difficult to maintain exactly this temperature during the operation. It will thus be clear that in the bath is the weak point of M. de la Bastie's process.

Herr F. Siemens, who has devoted considerable attention to the Bastie plan with the hope of overcoming some of its practical difficulties, appears to have become convinced that the invention is inapplicable to the fabrication of certain forms of glass, among which are included window panes. To these last any hardening process probably finds its most important application. After some experiment Herr Siemens reached the conclusion that solid bodies, or rather molds, could be substituted for the cooling bath. His first attempts, made with the object of hardening small squares of glass between plates of baked earth, showed clearly that the idea was practicable. This was eighteen months ago, and during the subsequent interval up to the present Herr Siemens has achieved constantly improving and successful results.

The *Deutsche Industrie Zeitung*, whence we take our facts, states that the method of fabrication of the compressed glass is not merely a glass-hardening process. It constitutes at the same time a veritable method of glass making. Tempering, blowing, and molding are all accomplished in one and the same operation.

It will be perceived, however, that all objects in glass cannot be made by this process, and that its application is restricted to such as can be pressed between two simple forms. To this category, however, belong window panes, to which at present Herr Siemens proposes to restrict his manufacture. In brief, the Bastie and Siemens methods may justly be regarded as each having its peculiar sphere. Bastie's plan is especially suited for cylinders, hollow glass, and other articles of complicated form, while Siemens' system, as already stated, is best applied to simple figures. The resistance of the Siemens glass to shock is stated to be ten times that of common glass, but its cost is about 50 per cent higher, except in case of curved window panes, when it is the cheaper. It is said to be harder than other tempered glass, and to present a fibrous instead of a crystalline fracture. It may be polished or pierced without the rupture which occurs in the Bastie glass. Herr Siemens is engaged upon still further improvements, which it is believed will tend to decrease the cost.

At the Lyons Industrial Society, recently, M. Leger proposed tempering bottles and similar glass objects by steam. The tensile resistance of the glass thus prepared, he states, is about equal to that of cast iron. No details of the process are given.

IS LIFE A MODE OF MOTION?

It can be demonstrated that motion is all-pervading; that absolute rest is inconceivable and that, in whatever form motion may appear, whether as motion or as light, heat, chemical affinity, magnetism or electricity, all are but phases of but one and the same great force. Science however does not stop with the enunciation of this truth, but following the same pathway onward is now brought face to face with the greatest problem within the ken of human conception, the question of the nature of life itself. There is something startling and overwhelming in the recognition of the fact that perhaps the greatest scientific minds on earth are keenly pressing forward toward the resolution of the mystery, not as speculators or dogmatists, nor as metaphysical advancers of abstract hypotheses; but progressing step by step, proving and reproving, leaving no by-path unexplored, no thread loose or weak in the wonderful fabric of facts which are slowly being interwoven. If Bastian and the believers in spontaneous generation are right, then life is the legitimate consequence of chemical affinity, for they claim to have substantiated by the clearest experimental proof that organisms in certain solutions previously free from life are due wholly to the proper chemical composition of such solutions. If this be true, then life must stand in the same category as heat and light and other sequences of chemical affinity—it is a mode of motion into which other modes of motion are convertible, and reciprocally it would follow that life itself is transformable into other phases of the all-pervading force.

THE TORPEDO DEFENSE QUESTION.

Despite the fact that the attention of inventors the world over is now directed to the problem of defending ironclads against torpedo attacks, progress toward its solution is slow. Captain Morton Singer, R. N., has been carrying on a series of experiments in the capacious repairing basin at Portsmouth, in order to find out the best form of netting to oppose to the Whitehead torpedo. It is now generally conceded that the netting system, although it in some measure acts as an impediment to the vessel's movements, is better than the proposed plan of fast small launches to be kept outside the vessel to head off torpedoes. Captain Singer has found that a chain net $\frac{5}{16}$ inch thick is easily perforated by the Whitehead torpedo, and he has obtained the best results from a wire grummet matting composed of wire strands about $\frac{1}{2}$ inch in thickness rove into open meshes. This yields gradually when struck and on recoiling throws off the torpedo.

A new submarine armor for vessels has been submitted to the Admiralty, and is intended to resist torpedoes. It is said to be so constructed that, while normally carried on the vessel's side out of the way of the guns, it may be drawn down over her bottom in five minutes. It is difficult to see how any device of this sort can be efficacious, as the explosion of a torpedo occurs along the line of least resistance, and it is hardly to be conceived that a vessel can be rendered so strong as to oppose more resistance than several feet of water tamping.

DR. THOMSON ON EMBRYOLOGY AND EVOLUTION.

The address of Dr. Allen Thomson, President of the British Association, which recently convened at Plymouth, England, is not one to excite the attention which scientific men, the world over, are wont to bestow on the discourse which yearly emanates from the chair he occupies. It is lengthy and technical—perhaps the latter was to be expected from so eminent a specialist—but the technicalities of biology are fully comprehensible to so limited a class that, without derogating from the scientific excellence of the address, we can scarcely think their introduction happy, especially as the discourse is usually understood to partake somewhat of the nature of a popular exposition.

The general tenor of the more important part was to set forth the parallel between the development of kinds, as conceived by the Darwinian naturalist, and the embryonic development of the individual as exhibited in any of the higher animals from the microscopic ovum upward. According to the evolution hypothesis, every such stage is the record of a condition once present in adult ancestors of remote generations—whence an explanation of the phenomena of embryonic life otherwise unaccountable. Dr. Thomson pronounced his opinion that the evidence of embryology in favor of the continuous development of species is conclusive; and considered that no theory which does not include the leading ideas of evolution, namely, variability, adaptation, and hereditary transmission, can bring the facts of embryology within a general law. The student of Haeckel will find the same argument brought forward by that writer with a wealth of illustration, so that the address was rather an endorsement of theories already formulated than a means of placing before the world any original hypotheses.

JOHN C. GRAHAM, of Grandville, Mich., contributes the following rule for estimating shingles for roofs: Divide 3,600 by the number of inches to be laid to the weather, and multiply this quotient by the number of squares to be shingled, and the product will be the number required.

VERY little is known of the first introduction of toothed wheels and toothed gearing. Two centuries before the Christian era, Hero, of Alexandria, spoke of toothed wheels in a manner that would indicate that he was conversant with this mode of transmitting motion.

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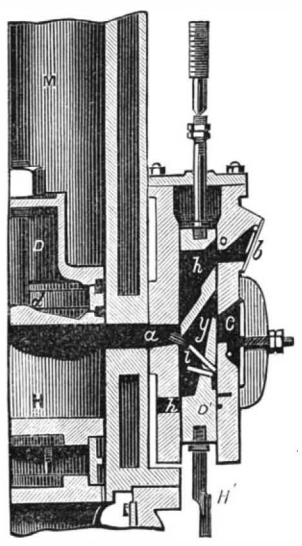
IMPROVED VERTICAL GAS ENGINE.

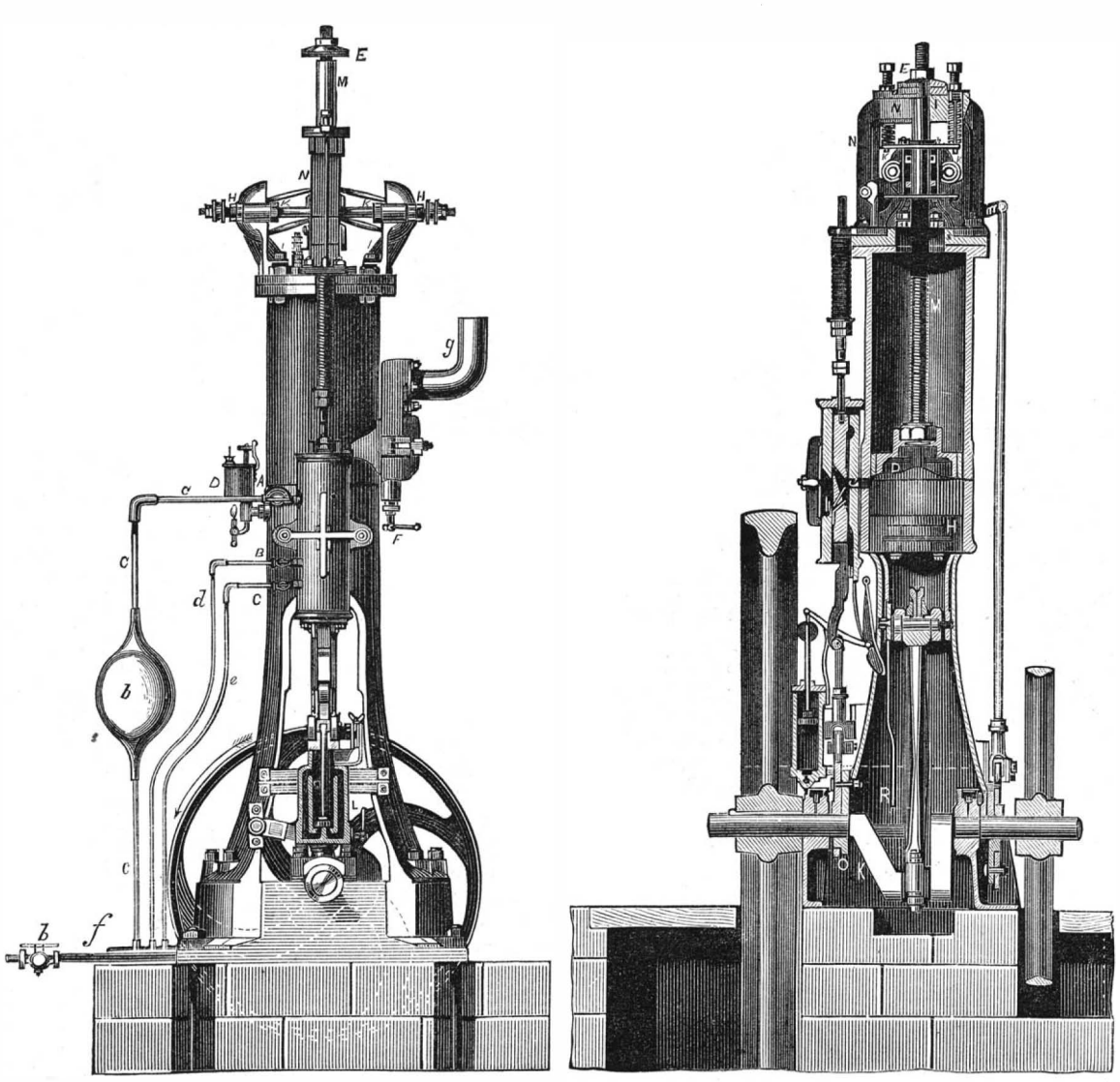
We illustrate a new gas engine which is being manufactured by Messrs. Louis Simon and Sons, of Nottingham, England, and is known as the Humboldt and Gilles' vertical gas engine. The illustrations, Figs. 1 and 2, show an elevation and section of the engine, and Fig. 3 gives the valves and parts of the piston in detail. The cylinder is fitted with the working piston, H, and the upper piston, D, the former being connected by a connecting rod to the crank, K, on the fly wheel shaft below; on this shaft is the cam, O, which works the gas slide, D^1, and also a cam which releases the clamp of the upper piston rod. The slide, D^1, has in it a cavity, *p*, and a sloped passage, *y*, and the slide jacket has ports, b^1 and c^1, for the admission of gas and air; *i* is a burner for admitting the kindling flame to the passage, *y*, which communicates also with an air port, *h*. The passage, *a*, into the cylinder in one position of the slide admits the mixture of air and gas supplied to the cavity, *p*, and during the rapid movement of the slide admits the kindling flame which ignites the mixture in the cylinder; a smaller passage is placed below the passage, *a*, so that when the latter is stopped by the loose piston head, *d*, the products of combustion still inclosed between the two pistons can only escape very slowly owing to the screw, F, it thus acting as an air buffer, preventing concussion of the two pistons. The passage, *a*, governed by the valve, *b*, permits the products of combustion to issue from the cylinder, the valve, *b*, closing to prevent ingress to the cylinder. In connection with the gas valve is a regulating pump, which is worked by the cam, O. The piston or sucker draws in and expels at each revolution a small amount of liquid. If the revolutions follow one after the other in too rapid succession, all the liquid cannot be expelled; this causes the lever attached to lift and hold stationary the bar, H^1, thus preventing a new charge of gas being given until the speed has diminished. The apparatus for clamping the rod of the upper piston, and preventing it from descending till the grip is relieved, consists of four levers, K, Fig. 1, pressed down by springs. The ends of the four levers, K K, Fig. 1, are rounded, and enter notches in a pair of clamps, N, which consist of a bush made in halves inclosing the piston rod. The levers, K K, are a little inclined upwards, so that, as they tend to come down to a horizontal position, they press the sides of the clamp, N, firmly against the piston rod, and grip it, thereby preventing it from descending until the eccentric, O^1, connected to the lever, *m*, top of Fig. 2, is brought round to such a point in its revolution as to raise the inner end of the lever, *m*, pushing upwards the clamp, N, and so relieving the piston rod and allowing the piston, D, to descend.

The operation of this engine is as follows: Assuming that the working piston is at the extremity of its stroke inwards, the loose piston being close to it, the former by t rotation of the crank is drawn outwards; and the loose piston, having on its opposite side the pressure of the air entering by the top, follows the working piston till it is stopped by the collar on its rod meeting the buffers provided on the cylinder cover. The working piston, continuing its movement, creates a partial vacuum behind it in the space between it and the loose piston. The cam having moved the gas slide so as to admit into this space the mixture of air and gas, admits the kindling flame whereby the mixture is exploded. The pressure produced by the explosion drives forward the working piston, and at the same time causes the loose piston to make a rapid stroke in the opposite direction, the air in the space beyond it being discharged through the space in the top cylinder cover. When the projecting upper head of the loose piston closes this space, the remaining air slowly escaping by a spring valve serves as a cushion to arrest its movement. The working piston having made its outward stroke, and the loose piston having also made its outward stroke, and the gas slide having closed, the space in the cylinder between the two pistons remains charged with the products of combustion at a pressure considerably below that of the atmosphere. The atmospheric pressure, therefore, tends to force both pistons inwards. The working piston moves inwards in obedience to this pressure, but the loose piston is held near the extremity of its outward stroke by the friction cheeks.

When the working piston is approaching the extremity of its inward stroke, the friction cheeks are slackened off the rod of the loose piston by the action of the eccentric, and the air slide is opened, The loose piston thereupon makes a rapid stroke inwards till it nearly meets the working piston, and the products of combustion, thus compressed between the two pistons, are forced out by the discharge valve on the side of the cylinder. The action is then repeated. From the above it will be seen that the engine is double-acting, a portion of the outward stroke of the working piston being effected by the pressure of the explosion, and the whole of its inward stroke by the excess of the atmospheric pressure over that of the products of combustion. The cylinder being open at both ends, no water is required to cool it; and the application of the principle of using gas explosion principally to produce a vacuum has produced what promises to be a successful engine.

Fig. 3.





HUMBOLDT & GILLES'S VERTICAL GAS ENGINE.

The Triple Conjunction of Mars and Jupiter.

The present year is distinguished by the triple conjunction and long-continued proximity of these two planets, which, though it may not afford any very striking spectacle, possesses considerable interest for those who follow the motions of the planets in the heavens. Both planets were in conjunction on July 27, Mars in its forward motion passing Saturn in right ascension. Mars afterwards reversed its apparent motion, and repassed, in its retrograde course, Saturn on August 15, and will, on November 3, pass a third time, and this time close to Saturn. There has been no triple conjunction between the two planets since 1779, and the next one will not occur till the year 1946. In the course of six centuries, from the year 1400 to 2000, ten such triple conjunctions may be counted, including that of the present year, which, though triple in right ascension, is not triple in longitude. During the same six centuries the number of triple conjunctions between Mars and Jupiter is six and between Jupiter and Saturn three, the latter occurring in 1425, 1682–83, and 1840.

Mixed Animal and Vegetable Fibrous Fabrics.

It has hitherto been the custom in manufacturing fabrics composed of wool and cotton or other vegetable fiber, either to card both raw materials separately, in order to subsequently mix them up and spin the two into yarn known as merino or angola, or to mix up the animal and vegetable fibers before carding. However, the spinnings so prepared share the common defect of showing a quantity of small knots or irregularities on their surfaces, so deteriorating the quality of the yarn very much. By a newly patented process, the cotton and wool, or other vegetable and animal fiber, are each carded separately in a carding-engine best suited to the particular fiber in question. These cotton and wool cardings are then laid one on the other, and so passed through another carding-engine, which thoroughly mixes up the two fibers together, when they are spun into yarn in the usual manner.

The carding-engine used for mixing up the two fibers together must be set, to prevent the fibers entering the card teeth further than is necessary to ensure their parallel laying. The yarns prepared after this manner are quite free from knots, and of a better quality than heretofore obtained.

A Worm Farm at Nottingham, England.

When at Nottingham a few days ago, I was much pleased at the discovery of an entirely new industry, namely, the rearing and education of worms for the purposes of anglers. Mr. Wells, fishing-tackle maker, of Sussex street, Nottingham, carries on a business and trade in worms. He has several people in his employ who collect worms every favorable night during the year. He sells the following kinds of worms, namely, the lob or dew worm, the cockspur, and the ring-tailed brandling. In dry weather worms are very scarce; the men have to water the ground for them. In wet weather the worms are better and heavier. They are caught in the meadows and pasture lands in the neighborhood; the supply is not failing.

The worms are sold by the thousand or the quart. In a warm, moist night from two to six thousand worms are brought in by the collectors. Some people can collect worms much better than others. The worms are very cunning, and are apt to pop back into their holes if the person treads heavily.

When the worms are brought in, Mr. Wells at once begins his training operations by placing them in properly selected moss. Stag's horn moss will not do at all, it is too harsh. Grass is bad. Field moss is the best. The worms are put into the moss to scour. A fresh-caught worm is very delicate and tender, and easily breaks up when put on the hook. When a worm is properly educated he is as tough as a bit of india rubber, and behaves as a worm should when put on a hook. The way to test a worm is to take him up and pass the finger gently down the length of him. If anything comes out of him he is not fit, and is put back for further training. The meaning of this is that the wild worms contain, more or less, food undergoing digestion. When put into the moss this food disappears. The moss in some way facilitates this operation, but I cannot quite see how this is, unless the worms disgorge all their former food, and practically become very little else than skin.

The keeping of worms depends very much upon the weather. They will not keep well above a week. Mr. Wells has a supply of worms ready for his customers all the year round. He goes over his moss very frequently, picking out the mauled and mashed worms, and only sending to market the plump and healthy ones, which are packed up for market in moss; the bags used are of light canvas.

Not only does Mr. Wells collect worms, but he also breeds them in considerable quantities. In his garden is a special heap made of vegetable matter, expressly for the purpose of breeding worms. I shall not, of course, say what substance for worm-breeding is most favorable: this is a professional secret. On turning the heap over where the worms are bred, it was very interesting to see the worms in various stages of growth. Mr. Wells knows from experience pretty well what the age of a worm is. I had the pleasure of pointing out to him the eggs of the worm. These are about three lines long, and somewhat oval. They had a sort of lid at each end, which opens when the young are liberated. I believe that two young are sometimes produced from the same egg.

The business of worm selling has been going on some ten years and is gradually increasing.—*Frank Buckland, in Land and Water.*

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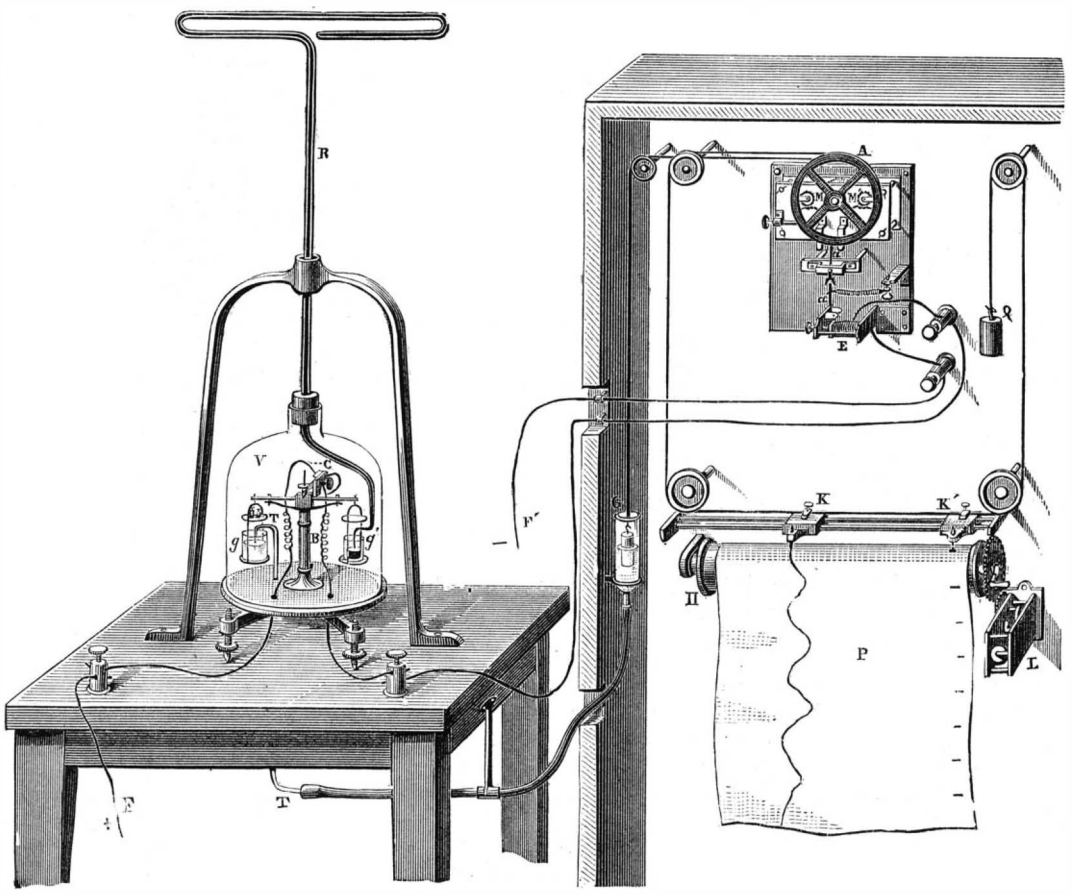
NEW REGISTERING THERMOMETER.

The annexed engraving, extracted from *La Nature*, represents M. Hervé Mangon's new registering thermometer. The instrument is composed of two parts, (1) the thermometer and the balance which serves to weigh the differences of weight which are the consequence of variations in temperature, and (2) the registering apparatus.

The thermometer, the mercurial column in which is amplified in diameter in our engraving in order to show it more clear, is composed of a very fine tube, R, so as to present large surface while really containing but a small volume of mercury. This tube, R, is sustained by an iron standard and enters the bell glass, V. Its extremity, drawn out very small, enters a small cup, *g'*, which contains mercury, and is placed on one of the pans of the scales, B. The latter is an ordinary accurate balance. Above the beam it carries a small disk which causes contact at C whenever equilibrium is broken owing to augmentation of temperature. The second scale pan also carries a cup, *g*, in which is glycerin. A glass tube, T T, connected with the registering device, plunges into this liquid and also connects with another and larger cup, G. The bell, V, covers the balance and protects it from the air. To adjust the instrument it is necessary simply to see that the end of the mercury tube enters the cup, *g'*, and then to equilibrate the balance by placing weights on the other scale pan. The registering apparatus consists of two clockworks, M and M', which travel in opposite directions and which rotate very delicate fly wheels with great rapidity. They are interconnected by a differential train, the axle of which carries a double-scored pulley, A. Between the two wheels a needle oscillates, one of the extremities of which serves alternately to stop one of the wheels. At the other end of the needle, *a*, is a small piece of soft iron on which the electro-magnet, E, acts whenever a contact of the balance occurs at C. The needle is mounted on an axis which allows it to oscillate in either direction according as it obeys the electro-magnet or an antagonistic spring.

The double scored pulley carries two wires, one attached to the pencil holder, K, and terminated by a stretching weight, Q, the other carrying a small cylinder which plunges in the cup, G, which contains glycerin, and which is, as already explained, connected with the cup, *g*. A cylinder, H, operated by a clock train, carries the paper on which a second pencil, K, serves to trace a mark by which the movement of the train, L, is regulated.

The operation is as follows: Suppose the temperature to augment, the weight of mercury in *g'* will increase, equilibrium will be broken, and the contact, C, will be established. The electro-magnet, E, will then attract the end, *a*, of the needle, and the wheel at M' will be free. The pulley, A, will then turn to the left, the cylinder will then sink in the cup, G, and the pencil will be directed toward K'. The float in G, descending, elevates the level of the liquid in that vessel and in cup, *g*, and hence will augment the weight in the scale pan on which said cup, *g*, is disposed, and thus up to the time when equilibrium is re-established and the contact, C, broken. The end, *a*, of the needle, now being no longer attracted by the electro-magnet, would be moved by the spring and would disengage the other fly wheel at M, when the pulley, A, turning to the right and drawing the pencil, K', towards K, causes the rising of the float in the cup, G, and hence diminishes the weight in cup, *g*. This loss of weight again destroys the equilibrium of the balance, contact at C is re-established, and the parts resume their primitive positions. In this way a zigzag line is produced on suitably ruled and marked paper, from which the variations and changes of temperature may be noted.



MANGON'S NEW REGISTERING THERMOMETER.

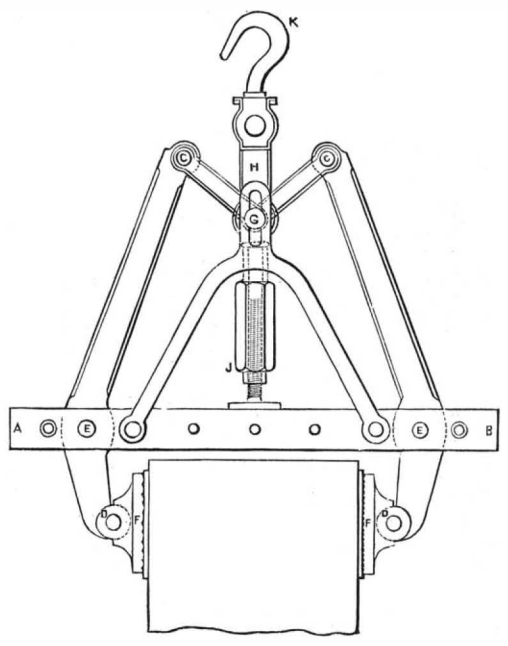
A New Explosive Bullet.

Captain C. S. O'Hara, of New Orleans, La., lately made some experiments at the Crescent City Rifle Park with his new explosive and igneous bullet. A large chest made to represent the caisson of field artillery, was charged with powder and set on tressels. At a distance of one hundred yards a bullet was fired into the chest, which was blown up. Shavings and wood, in which there was no powder, were set on fire by being fired into. A post was rigged as a ship's mast, with a yard or sail furled. This was shot at and partially burned, the canvas readily igniting by the explosion of the bullet.

The inventor claims that shells or bullets of any size may be made on the same principle, and that the material with which they are charged may be handled with as much safety as gunpowder, and that time and climate will have no deteriorating effect upon it.

NEW HOISTING CLAMP FOR BUILDING STONE.

We extract from the *Bulletin de la Société d'Encouragement pour l'Industrie Nationale* the annexed engraving of a new apparatus for hoisting building stones while the same are being hoisted into position. In principle the weight of the



stone itself is used to act upon levers so that the block is tightly grasped as it were in pincers. C D and C' D' are arms pivoted at E in the piece, A B. To the lower ends of these arms are attached the clamps, F, and to the upper extremities are pivoted short arms which form a V at the point, G, in the vertical piece, H. To the latter is secured the hook, K. J is a screw which serves to elevate the point, G.

In using the apparatus the clamps are placed on the sides of the stone, as shown, and the screw, J, is elevated. By this means the outer ends of the arms, C D and C' D', are forced apart and the clamps pressed against the block. When the whole is lifted by the hook the tendency of the V arms, C G and C' G, is to open, when the weight of the stone itself causes the clamps to be forced the more tightly against it. The holes in the piece, A B, serve to adjust the pivot points, E, of the large arms to any size of stone.

How to Test Boiler Steel.

In a paper in the September number of the *Metallurgical Review* Mr. William Metcalf, a Pittsburgh steel manufacturer, says: "Perhaps the greatest development of steel for structural purposes up to this time may be found on railroads. The question of steel rails may be regarded as settled; also of steel tires, crank pins, guide bars, connecting rods, etc. In case of axles and boilers there seems to be some discussion, but no close observer can doubt the ultimate result. In boiler steel the only danger to be apprehended is that there may be enough carbon in the steel to cause hardening in use, although the sheets may have been annealed so as to endure all the cold bending, twisting, punching, and flanging tests successfully. That such annealed sheets will harden very hard in use is well known. A very simple preventive may not be so generally known.

"Let a piece from each sheet be heated white hot and quenched in cold water or brine. If, after this treatment, it will double over cold, punch, twist, flange, etc., it will never harden in use, simply because it has not enough carbon to cause it to harden under any circumstances. There are instances of boilers that have been in active service for nearly ten years, when only 20 per cent of a large number have required any repairs, and all are reported in good working condition. It is evident that the life of a boiler must be very long under fair treatment, after it has run for about nine years subject to ordinary wear and has not required any repairs whatever."

SCIENCE AT THE BRITISH ASSOCIATION.

The papers read at the recent session of the British Association at Plymouth, England, are quite rich in new scientific ideas. Their lengths precludes our touching on more than their salient points—but these will suffice to exhibit the wide and interesting range of the subjects discussed.

LIFE FROM OTHER WORLDS.

Sir William Thomson revived that curious paradox of the possibility of life coming upon our earth directly from other worlds—the vehicle being a meteorite. Biologists at present are not in accord as to what temperature is fatal to germ life; and it is believed that some germs come safely through extremes of temperature that are fatal to the species in a more advanced stage. On this rather doubtful foundation, Sir William bases his idea that a germ might hide away in a crevice of a meteorite, so that the intense heat of the exterior might not reach it, and hence it might remain alive after the wandering mass had come to rest on the earth. One objection at least to this theory will suggest itself to the readers of Mrs. Ingram's interesting essay—read before the American Association, at Nashville, Tenn.—and that is, if that fair scientist is right about concussion being fatal to germ existence, then the shock of the meteorite striking the earth, if not due to its contact with the atmosphere, would be quite sufficient to destroy the traveling organisms.

THE INDUSTRIAL VALUE OF SCIENTIFIC RESEARCH.

Professor Abel made a capital review of the operation of purely scientific research in developing important branches of industry. He instanced Perkins' researches in the coal tar colors, and more especially referred to the recent improvements in the steel manufacture. He pointed out that the success which has attended the addition of silicon in combination with iron and manganese to the steel before casting in the preventing the formation of blow-holes, and in contributing at the same time to the production of the particular character of steel required, bids fair to be of special importance in connection with the application of steel to the production of projectiles for use against armor plates and of castings which will compete successfully with carefully forged metal, or even with the Whitworth compressed steel. He also alluded to the advantages of steel armor over iron, and stated that promising results have recently been obtained at Shoeburyness with a new system of applying steel in conjunction with malleable iron, by which a perfect union of the two materials at one of their surfaces is obtained by the aid of heat. Reference was also made to the late investigations into the physical nature of gunpowder, which among other things have demonstrated that modifications in composition, not unimportant from an economical point of view in dealing with the very large charges now employed, may materially contribute to render the storing of the maximum of work in the projectile, when propelled from a gun, compatible with a subjection of the gun to comparatively very moderate and uniform strains.

WAVE ENERGY.

Professor Osborne Reynolds demonstrated mathematically that, in waves on deep water, the rate at which the energy is carried forward is one half the energy of disturbance per unit of length multiplied by the rate of propagation. When the waves enter shallow water the motion of the particles becomes elliptical, the eccentricity depending on the shallowness of the water: and it may be shown that under these circumstances the rate at which energy is transmitted is increased, until when the elliptic paths approach to straight lines the whole energy is transmitted, and consequently it follows that the rate of speed of the groups to the speed of the waves will increase as the water becomes shallower until they are sensibly the same.

It is claimed, though the fact does not rest on sufficient authority, that the organ is the invention of Archimedes, about 200 years B.C. The invention is also attributed to a barber of Alexandria, named Ctesibus, about 150 years B.C.

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Communications.

Our Washington Correspondence.

To the Editor of the Scientific American:

The second extension case, that of H. Voelter, wood pulp machine, authorized by Congress, as mentioned in my last letter, has been decided in faver of the applicant, provided he will enter a disclaimer to the third claim of his patent, as re-issued June 6, 1871. It appears from the papers in this case that the present rate of manufacturing pulp by the machines covered by this patent is about 60 tons daily, with a steady increase in prospect, as paper made from pulp so manufactured is found to be peculiarly suited for the web newspaper presses. The evidence presented by the applicant shows that this pulp is manufactured at from 2½ to 3 cents per pound, while similar pulp from rags would cost 6 cents. As there were 75,000 tons of Voelter pulp made last year, at a cost of $4,500,000, and the same quantity of rag pulp would cost $9,000,000, it follows that one half of this amount, or $4,500,000, was saved by this process last year, to say nothing of the increase of the price of rag pulp which would result if the competition of the wood pulp were withdrawn; for before this process of wood pulp making was introduced, rag pulp was worth 10 cents per pound—part of this decrease, however, is probably chargeable to the general shrinkage of values.

Our Consul at Liverpool has sent to the State Department a dispatch, which should be considered as a strong warning to American mechanics against going abroad for employment unless under contract, and even then they will find themselves in the disagreeable position of taking the places of men who have struck for wages which are barely sufficient to enable them to maintain themselves and families in comfort, as is the case with the thirty-five carpenters who recently landed in England, who were simply brought over to fill the places of English carpenters on strike. Referring to these men, and to the published statement in some American newspapers that fewer men are out of employment in England than in the United States, the Consul particularly warns our mechanics against the danger and loss of putting these statements to the test, which reports have induced many American mechanics to leave their country to better their condition, and the result has been a large amount of suffering and destitution. To avoid any further augmentation of this suffering, the Consul requests that public warning be given to American workmen not to go to England unless under positive contract with responsible parties. Able-bodied American mechanics are calling upon the consulate daily for relief, and are greatly disappointed when they learn that consuls have no money for such relief purposes. Under these circumstances the Consul deems it his duty to inform the Department that neither skilled nor unskilled laborers who come from abroad can readily find employment in England, except in cases where they are engaged to fill the places of British workmen while on strike.

A dispatch has been received by the Secretary of State from the United States Chargé d'Affaires, at Paris, announcing that the immense exhibition buildings on the Champ de Mars and the Trocadero are nearly completed, and the foreign commissioners are about to take possession of the positions assigned them. It is stated that great solicitude is felt by the administration of the exposition in regard to the intention of the United States Government, no official notice having been received as to whether any commission will be sent to Paris or not. The legation is in daily receipt of letters from the United States, applying for information as to space, etc. The Chargé d'Affaires has been assured by the Commissioner General that the portion reserved in the original designs for the United States will be still retained to last possible moment, but that the time is rapidly approaching when the commissioners must know whether the United States will do anything in the matter or not.

There seems to be considerable doubt here about the Administration taking any steps to have the United States represented officially at the exhibition, except in response to a direct order from Congress, as it is stated that many persons of influence, having an interest in a full representation of American industry at Paris, have called upon the President and Secretary Evarts, and desired them at least to appoint a provisional commission, but no steps have been taken to do even this much, nor do they appear likely to be. This, it is stated, may be owing to circumstances connected with the Philadelphia exhibition, in which neither the action of the French Government nor its exhibit was such as the United States Government had a right to expect. Instead of sending, as other nations did, special commissioners of high rank and experience, France entrusted her exhibit to subordinate attachés of the French Legation, one of whom was so objectionable to President Grant that he is said to have refused to accept an invitation to a public dinner at Philadelphia until he was assured that this person would not be present. The letters attacking the United States, which caused so much stir, although disclaimed by the supposed author, were believed to have been written by one of them. In addition to this, certain of the French exhibitors were found attempting to defraud the revenue, which made it necessary for our customs officials to submit all foreign exhibitors to very annoying restrictions. But independent of these minor matters, the character of the exhibit itself was not what might have been expected from France, and this was believed to be caused by the lack of interest, if not opposition, of the French Government. Secretary Fish, therefore, when the invitation to participate in the exposition was received, transmitted it to Congress without recommendation; and it is reported that he gave substantially the above reasons to the Committee on Foreign Relations, when consulted on this subject, why he was unwilling to urge Congress to accept the invitation. This feeling is believed to be shared to some extent by the present administration, and may explain why it has been unwilling to assume any doubtful authority for the purpose of securing the representation of the United States at the Paris Exposition. Notwithstanding this, it is thought that the matter will be brought before Congress at an early day, as so many American manufacturers are desirous of exhibiting specimens of their wares; and in the present depressed condition of our industries, the administration wishes to do all it can to open new markets for our productions.

The United States Consul at Munich has forwarded to the State Department circulars announcing an exhibition of hops, and of tools and implements used in their cultivation, to which all nations are invited to contribute. The exhibition will be held in Nuremberg, from the 7th to 15th of October, and may possibly help to open a market for many of the appliances connected with hop growing that have been patented of late.

From a letter just received in this city from our Chargé d'Affaires at Madrid, it appears that Spain has reduced her tariff on imported goods, but has excepted England, France, and this country from the benefits of the reduction, so that hereafter English, French, and American manufacturers who send goods to Spain will have to pay from 30 to 50 per cent more than those of Germany, Switzerland, and other European nations.

Commander Rodgers, of the United States steamer Adams, reports to the Navy Department that he has discovered a bank of considerable extent in 17° 6′, south latitude, and 36° 44″, west longitude. It is situated about 135 miles east of the coast of the province of Espirito Santo, Brazil, and 130 miles northeastward of the Island of Abrolhos, in the South Atlantic Ocean. It is right in the course of vessels bound southward and northward from Rio de Janeiro. One of our papers here expresses a hope that it will be a long time before there is a *run* on the bank.

Washington, D. C. OCCASIONAL.

Reforms Needed in Railway Bridge Construction.

To the Editor of the Scientific American:

It seems as if the recent railway accidents, and particularly the one near Des Moines, Iowa, might call attention to some of our engineering miss-constructions. In this case a masonry culvert is built on short piles. The water washes away the earth that holds the piles in an upright position, and they go down like a row of bricks. To simplify it, drive your cane in the earth three inches, put your hat on the head of the cane, dig or wash away the earth at the bottom of the cane, and it falls. Short piles may be a handy method of holding a structure up, but it is a sure method of letting it down in a water way. At the ditch to which these short piles are driven a concrete foundation can as easily be laid (or at least concrete can be put around the piles, holding them together). On such a foundation masonry can be securely built, or, what is better, make the whole structure a monolith of béton. The structure then holds itself securely together, there is no thrust. If a part is undermined, the rest supports it. The weight may be distributed over a large surface, or the culvert may be made in the shape of a pipe, forming its own invert which becomes its foundation. In a thousand years there seems to have been no improvement in masonry structures. We have copied to an extent the old superstructures, and have gone without foundations. The Washington monument is a sad specimen of our national skill as engineers, and the cracking and fall ing specimens of architecture in New York city are evidences that we should begin at the bottom.

JOHN C. GARDRIDGE, JR.

Operating Canal Lock Gates.

To the Editor of the Scientific American:

The subject of opening and shutting canal lock gates is being considerably discussed here owing to the aggravating interference of drift, mud, etc., with the working of the machinery of the lower gate of lower lock of the DesMoines Rapids Canal. I would suggest an effective and simple means of accomplishing the opening and shutting, namely, to employ a strong jet of water through two way nozzles, to be placed permanently in the toe of the gates. and there may be other jets along the foot of the gates to clear away mud, drift, etc., in the passage of the gates, while a greater number of the nozzles playing from the opposite side of the gate would propel it in the required direction.

Keokuk, Iowa. ALEX. BLACK.

Defective Rubber Hose.

To the Editor of the Scientific American:

N. D. in your issue of August 18 complains of the inferior quality of rubber hose as at present made. He thinks that, with more care in its manufacture, its value would be at least double what it is. I beg to inform him that though the greatest care is taken in its construction it will remain in its present defective state just so long as it continues to be handmade. Let us review the process of making hose, and in doing so I think I can show plainly where its weakness lies. Any one acquainted with the nature of rubber is aware of its great expansion during the process of vulcanization. To control this expansion within proper limits is to add strength, to be unable to control it is to weaken it. A long hollow mandrel or pole is taken and around it is wrapped a thin coat of rubber in sheet form. This constitutes the inner lining. Then a strip of cotton duck saturated with rubber is wound around, one, two, three or more times, according to the number of ply required. A coating of rubber like that used on the interior is then put on the outer side. It is wrapped up in cloth, vulcanized, and the hose is made. When it comes to putting the wrapper around, if one twist is slacker than another or one edge does not evenly overlap the other, when the expansion takes place at that place there will be a loose spot or blister; after a short time in use the continual bending backwards and forwards will further rupture these already weak spots. From its imperfect make, it permits the water to circulate between the layers of cotton duck which soon becomes rotten.

Cleveland, O. H. J. MERREUS.

A Reply to the Question of Axial Change of the Earth.

To the Editor of the Scientific American:

The earth's axis and its inclined position seem to depend upon attraction of gravitation, or magnetism in the direction of the north star. Such an attraction to be permanent must be exerted upon the mineral portion of our globe, and we find the greatest amount of land in the northern hemisphere; but the corroding agencies before alluded to are gradually wearing it away, and, in obedience to the law of centrifugal force, this débris is gradually finding its way to the periphery or equator; hence we find our northern shores rock bound coasts, and as we approach the equator, sandy flats. The same peculiarity exists in the southern hemisphere. The diameter of the earth at the equator is 20 miles greater than at the poles. The water exhibits the greatest parts of this distention, and forms a belt from 5 to 10 miles in depth around the earth at the line. To what extent the mineral deposits have accumulated there we cannot tell; but whenever they shall have accumulated to such an extent at any point of the equator as to exceed that in the northern hemisphere, that part will gravitate toward the north or polar star, opposite points on our present equator will become the new poles, or axis in doing so, this great belt of water in finding its new position will sweep over one half the globe, a quarter upon each side, thus causing another deluge, throwing up new mountain ranges, burying continents and elevating others, bringing arctic regions into tropical climes and portions of our present equator into arctic frosts. This, like all the preceding revolutions of our planet, will be sudden and violent.

Philadelphia, Pa. ALEXANDER BOND.

ANCIENT LIFE IN AMERICA.

Professor O. C. Marsh, of New Haven, recently delivered before the American Association for the Advancement of Science an address on the "Introduction and Succession of Vertebrate Life in America." According to present knowledge, he stated, no vertebrate life is known to have existed on this continent in the archæan, Cambrian, and silurian periods, yet during this time more than half the thickness of American stratified rock was deposited. Fishes are known in the upper silurian of Europe, however, and there is therefore a probability that they will be yet discovered in our strata of the same age, if not at a still lower horizon. Passing through the various geological periods, Professor Marsh noted the extinction or increase of various orders of fishes, and then, referring to the amphibia, stated that the latter are so nearly allied to the ganoid fishes as to leave little doubt of their descent from some member of that group. The earliest evidence of their existence on this continent is in the sub-carboniferous, where footprints have been found which probably were made by labyrinthodonts, the most ancient representatives of the class.

ORIGIN OF THE BIRDS.

During the mesozoic period some of the strangest forms of reptilian life made their appearance and became extinct. Then came the dinosaurs, true reptiles, yet having characteristics peculiar to birds of the ostrich order, so that it is possible that they were the parent stock of all birds. Professor Marsh's account of the great saurian monsters of the cretaceous strata is wonderfully interesting. He told of vast lizards, some sixty feet in length, which inhabited the inland cretaceous sea when the Rocky Mountains were just beginning to rise above the waters. In a valley of this old ocean bed he had seen seven different skeletons of these monsters in sight at once. There were also the huge plerosauria, the veritable dragons, having a spread of wings of from ten to twenty-five feet, and one colossal dinosaur, when erect, stood thirty feet in height.

BIRDS WITH TEETH

existed in that strange world. The aquatic hesperornis, nearly six feet in height, had teeth set in grooves in its jaws. It was a carnivorous, swimming ostrich. The ichthyornis, a small flying bird, had teeth set in sockets, while strange enough, the companions of these ancient toothed birds were pterodactyls, without teeth.

There came a period at last when the dinosaurs and other mesozoic vertebrates disappeared, and mammals henceforth became the dominant type. Then lived a great sloth, which, after the elevation of the Isthmus of Panama, crossed over from the northern to the southern continent of America, there found a more congenial home, and there in time became extinct. In the middle eocene, west of the Rocky Mountains,

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THE DINOCERATA,

a remarkable group of ungulates, made its appearance. Nearly equalling the elephant in size, this animal had shorter limbs, while arming its skull were two or three pairs of horn cores, besides enormous canine tusks. In the lower eocene appeared the progenitor of the horse, the eohippus, about the size of a fox and having well developed toes. In the lowest eocene appear the artrodactyles, the ancestor of the pig, and in the upper eocene comes the oromeryx, whence probably sprang the deer.

THE PRIMATES AND MAN.

We come now to the highest group of mammals, the primates, which includes the lemurs, the apes, and man. This order has a great antiquity, and even at the base of the eocene we find it represented by several genera belonging to the lower forms of the group. In considering these interesting fossils, it is important to have in mind that the lemurs, which are usually regarded as primates, although at the bottom of the scale, are only found at the present day in Madagascar and the adjacent regions of the globe. All the American monkeys, moreover, belong to one group, much above the lemurs, while the Old World apes are higher still, and most nearly approach man.

In the lower eocene of New Mexico we find a few representatives of the earliest known primates, and among them are the genera *lemuravus* and *limnotherium*, each the type of a distinct family.

The oldest known remains of man on this continent differ in no important characters from the bones of the typical Indian, although in some minor details they indicate a much more primitive race. These early remains, some of which are true fossils, resemble much more closely the corresponding parts of the highest Old World apes, than do the latter our tertiary primates, or even the recent American monkeys. Various living and fossil forms of Old World primates fill up essentially the latter gap. The lesser gap between the primitive man of America and the anthropoid apes is partially closed by still lower forms of men, and doubtless also by higher apes, now extinct.

The real progress of mammalian life in America, from the beginning of the tertiary to the present, is well illustrated by the brain-growth, in which we have the key to many other changes. The earliest known tertiary mammals all had very small-brains, and in some forms this organ was proportionately less than in certain reptiles. There was a gradual increase in the size of the brain during this period, and it is interesting to find that this growth was mainly confined to the cerebral hemispheres, or higher portion of the brain. In most groups of mammals the brain has gradually become more convoluted and thus increased in quality as well as quantity. In some, also, the cerebellum and olfactory lobes, the lower parts of brain, have even diminished in size. In the long struggle for existence during the tertiary time the big brains won, then as now; and the increasing power thus gained rendered useless many structures inherited from primitive ancestors, but no longer adapted to new conditions.

Another of the interesting changes in mammals during tertiary time was in the teeth, which were gradually modified with other parts of the structure. The primitive form of tooth was clearly a cone, and all others are derived from this. All classes of vertebrates below mammals, namely, fishes, amphibians, reptiles, and birds, have conical teeth, if any, or some simple modification of this form. The edentates and cetaceans with teeth retain this type, except the zeuglodonts, which approach the dentition of aquatic carnivores. In the higher mammals, the incisors and canines retain the conical shape, and the premolars have only in part been transformed. The latter gradually change to the more complicated molar pattern, and hence are not reduced molars, but transition forms from the cone to more complex types. Most of the early tertiary mammals had forty-four teeth, and in the oldest forms the premolars were all unlike the molars; while the crowns were short, covered with enamel, and without cement. Each stage of progress in the differentiation of the animal was, as a rule, marked by a change in the teeth; one of the most common being the transfer, in form at least, of a premolar to the molar series, and a gradual lengthening of the crown. Hence, it is often easy to decide from a fragment of a jaw to what horizon of the tertiary it belongs. The fossil horses of this period, for example, gained a grinding tooth, for each toe they lost, one in each epoch. In the single-toed existing horses, all the premolars are like the molars, and the process is at an end. Other dental transformations are of equal interest, but this illustration must suffice.

The changes in the limbs and feet of mammals, during the same period, were quite as marked. The foot of the primitive mammal was doubtless plantigrade, and certainly five-toed. Many of the early tertiary forms show this feature, which is still seen in some existing forms. This generalized foot became modified by a gradual loss of the outer toes, and increase in size of the central ones; the reduction proceeding according to systematic methods, differing in each group. Corresponding changes took place in the limb bones. One result was a great increase in speed, as the power was applied so as to act only in the plane of motion. The best effect of this specialization is seen to-day in the horse and antelope, each representing a distinct group of ungulates, with five-toed ancestors.

THE sharpening angle of ordinary soft wood planing machine irons should be about 35 degrees, and for hard wood tool cutters, 50 to 55 degrees.

The Uses of Fish Skins.

Although the skin of some marine mammals, such as those of the seal, walrus, and the white whale or beluga (known as porpoise leather), have long been commercially employed, it is only lately that attention has been more generally directed to the utilization of fish skins on an extended scale. Their employment hitherto has been very limited. Eel skins have been used for the thongs of whips and the attachments of flails, dried sole skins to clarify coffee, and some shark and ray skins by workmen to smooth and polish substances, and also to make a kind of shagreen leather.

At the Maritime Exhibition held at the Westminster Aquarium this year Mr. G. Kent, of Christiana, Norway, exhibited a variety of tanned skins, among which were:

1. Whale skins tanned; the size ranges from 12 inches broad by 60 feet in length, suitable for wheel bands, for driving machinery, etc.

2. White fish, for upper leather, which can be prepared in pieces of 12 feet by four feet.

3 Skins of various flat fish, dressed and prepared for gloves. Fine upper leather can be made, often to be had in sizes up to 3 feet square.

4. Skins of soles, dressed and tanned suitable for purses, etc.

5. Skins of thornbacks, suitable for cabinet makers instead of sand paper, and very much more durable.

6. Skins of eels, dressed and dyed, suitable for braces and other purposes.

In Mon. Chas. Varey's "Scientifique Correspondence" from Paris, of August 7, mention is made of an industry carried on at Colburn, in Canada, in the skins of species of silurids for glove making, and this is to be prosecuted on a larger scale, both for the flesh for salting and the skin for currying.

Shoes have been made in Gloucester, Massachusetts, from the skins of the cusk or torsk (*Brosmus vulgaris*), the use of which has been patented. If this material for shoes proves what it promises, it will open up a new market for fish skins, which will no doubt be highly profitable. In Egypt, fish skins from the Red Sea are used for soles of shoes. In the Animal Products Collection at the Bethnal Green Museum there are some tanned sole skins shown. The skin of the losh or burbot (*Lota maculata*), cleansed, stretched, and dried, is used by country people in many parts of Russia and Siberia to trim their dresses, and instead of glass for the windows of their dwellings, being as transparent as ciled paper. It is also utilized by some of the Tartar tribes, as material for their summer dresses, and the bags in which they pack their animal skins. The inhabitants of the eastern coasts of the middle of Asia clothe themselves with the tanned skins of the salmon. It is asserted that it makes a leather as tough as wash leather. The scale marks give a very neat pattern to the leather.

W. Brozowsky, in his "Waarenkunde," Vienna, 1869, under 'Fish Skin," says it is obtained from the sea angel (*Squalus squatina*, Lin.; *Squatina lævis*, Cuv.), the thorny shark (*Squalus acanthias*, *Sq. carcharias*), the tigered shark *Sq. caniculata*), and some skates, as the angel skate (*Raja rhinobatis*) *Rajo Sephen*, etc. The skins of these skates and sharks have spines of different sizes instead of scales. The skins are used for polishing, and, after the star-formed spines have been smoothed down with sandstone, for covering boxes and cases, etc.

The "Waaren Lexicon" of T. C. Schedel enumerates the following fishes: Sea dog (*Squalus blainvellei*, Riss, Aiguillat, Blain), *Sq. aranthias*, and other small sorts, *Sq. carcharias*, Lin., *Sq. canicula*, and *Sq. catullus*.

Guibourt (sixth edition, by Dr. G. Planchon, 1870–71, vol. iv.), says, "The sephen of the Red and Indian seas, belonging to the genus *Trygon*, produces the tuberculous and hard skin called galuchat, after the name of a Paris workman who employed it first. The greater part of the selacians, namely, the roussettes, sharks, humantins, aigullats, leiches, etc., have a rough skin, which is used for covering boxes, and also for polishing wood. The greatest confusion exists among merchants as to the names given to the different skins. Each tradesman applies, according to his fancy, the name of *peau de requin*, *peau de chien de mer*, *chagrin*, and even *galuchat*. I endeavored to obtain specimens of the various skins, in order, if possible, to determine the species.

"1. Shark skin, from a young shark; small, imbricated scales, somewhat translucid, with longitudinal lines, the borders or edge entire and circular. The edge is free on the body, but attached on the fins. The skin serves for covering cases, etc., but is not rough enough for polishing.

"2. Skin of mottled *roussette* (*Scyllium*, Cuv.). Tuberculous, imbricated, horny, fine and hard scales, very near one to the other, and transparent, each triangular. Skin much used for polishing. Some persons state that 'false galuchat' is made of it by rubbing off the scales, which leaves a square figure that becomes very showy when the skin is applied on a green paper. I rather believe (continues M. Guibourt) that the false galuchat is made with the skin of the aiguillat.

"3. *Peau de leiche* (*Scymnus*), sold to cabinet makers under the name of *peau de chien de mer*, is covered with nearly rhomboid tuberculous semi-transparent scales, arranged one near the other in quincunxes.

"4. *Peau d'aiguillat* (*Spinax acanthias*, Cuv.). Viewed with a magnifying glass, this skin appears covered with small square opaline scales, not rough like the preceding, but much used by the 'gainiers' or sheath makers, for its glossy nacreous aspect.

"5. *Peau de sagri* (*Spinax niger*, Cuv.). Same uses as the preceding. The word *Sagri* is Persian; *Sagher*, Turkish, from its resemblance to the dressed leather made from the mule and ass, whence our word shagreen.

"6. *Galuchat* or *sephen* skin, from the back of the *Trygon sephen*, Cloq., It has numerous round tubercles, which become white by rubbing down, and in the interior opaque and nacreous. The skin is sometimes dyed for different colors, but it is often preferable to leave it the natural color by only half polishing it."

The quantity of ray skins, dried or salted, imported into France in 1863 was about 18,000 lbs. weight, principally from Portugal. Formerly they used to fetch as high as 7 francs the pound, now they may be had for 1s. a pound.

The best galuchat, or what we should call shagreen, is made from the skin of the sephen, which abounds in the Mediterranean Sea, and is also met with in the Red Sea and the Indian Ocean. This skin is remarkable for the size of the osseous protuberances. There are however two kinds of these rays, one with rough skin and the other with smooth.

From a certain portion of the skin of the angel shark (*Squatina angelus*) the Turks make the most beautiful sea-green watch cases. These sharks, which form a connecting link between the genera of rays and sharks, are found in the Mediterranean principally, and the German Ocean sometimes. The skin being very rough, it is employed to polish wood and ivory, as well as for other uses in the arts.

Turners, ebonists, and carpenters in Europe use the rough skin of the blue dog fish (*Squalus glaucus*, Linn.) like emery paper, for smoothing their work and preparing it for polishing. This shark skin is also used by the native workmen of the East for polishing wood and ivory, and it is made into shagreen. The best is that obtained from the *Rai Seplien* of India and the Red Sea. That most used now seems to be the skin of the ray (*Hypolophus Sephen*) which is very common on the Malabar coast, and an extensive commerce is now carried on in them in the Indian Ocean; they are found in the Sea of Oman, and also taken at Mahe. The house of Giraudon, 48 Rue Molière, Paris, makes excellent use of them for morocco and tabletterie.

Peau de Roussette (*Squalus catulus* and *caniculus*, Lin.). This fish, called *chat* at Marseilles, and *crin* in Catalonia, is smaller than the angel fish. The skin, reddish and without spots, is of a uniform grain, flat, and only used to make cases and other articles known as shagreen. These skins come from the Mediterranean, and are imported in bundles by the sailors, selling, according to size, from 30s. to 36s. the dozen.

Peau de chien de mer is another name given in France to some species of *Squalus* or *requin*. That usually found on the French coasts is known under the names of *chien marin*, *chat marin*, *roussette tigrée* (*Squalus catulus*, Linn.). Turners, cabinet makers, and carpenters use the skin for scraping and smoothing their work before polishing; metal workers and others also use it. This skin, when worked up with the tubercules with which it is studded, takes the name of galuchat, and is ordinarily dyed green, to cover cases, sheaths, and boxes. Under the name of *chagrin* these skins used to be much employed in Turkey, Syria, Tunis, and Tripoli. That made in Constantinople was considered the best. It was colored black, green, white, and red.—*By P. L. Simmonds, in the Journal of the Society of Arts.*

Rules for Calculating the Speed of Pulleys.

The diameter of the driven being given, to find its number of revolutions:

Rule—Multiply the diameter of the driver by its number of revolutions, and divide the product by the diameter of the driven; the quotient will be the number of revolutions of the driven.

Ex.—24 inches diameter of driver×150, number of revolutions, =3,600÷12 inches diameter of driven=300.

The diameter and revolutions of the driver being given, to find the diameter of the driven, that shall make any given number of revolutions in the same time:

Rule—Multiply the diameter of the driver by its number of revolutions, and divide the product by the number of required revolutions of the driven; the quotient will be its diameter.

Ex.—Diameter of driver (as before) 24 inches×revolutions 150=3,600. Number of revolutions of driven required=300 Then 3,600÷300=12 inches.

The rules following are but changes of the same, and will be readily understood from the foregoing examples.

To ascertain the size of the driver:

Rule—Multiply the diameter of the driven by the number of revolutions you wish to make, and divide the product by the required revolutions of the driver; the quotient will be the size of the driver.

To ascertain the size of pulleys for given speed:

Rule—Multiply all the diameters of the drivers together and all the diameters of the driven together; divide the drivers by the driven; the answer multiply by the known revolutions of main shaft.

FILLING FOR CRACKED CEILINGS.—Whiting mixed with glue water or calcined plaster and water makes a good putty for filling cracks in plastered ceilings.

BLACK WALNUT STAIN.—Asphaltum thinned with turpentine will stain a beautiful black walnut color. It must be varnished over.

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IMPROVED BALL CHECK VALVE FOR SEWERS.

The invention herewith illustrated consists in providing the valve case or body, in rear of the valve seat, with a diverging channel into which the valve passes when it leaves its seat and through which the reflux water passes to carry the ball to its seat again. When the ball is back the water is allowed a direct unobstructed passage, but when the reverse movement of the water begins the valve is quickly closed.

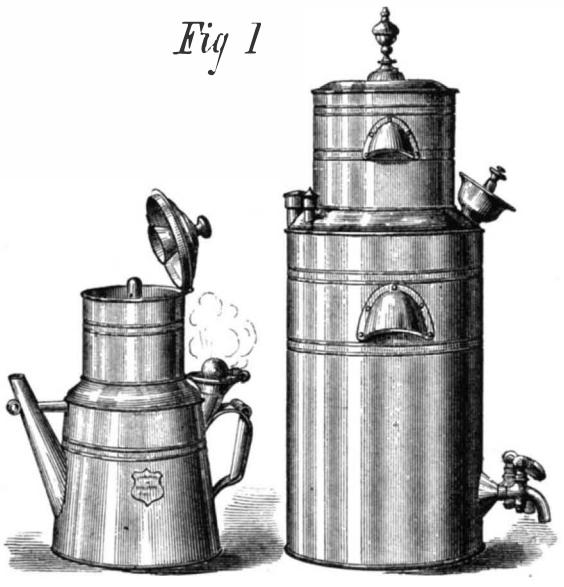
The engraving represents a horizontal section of the case, placed with an inclination downward from right to left. It is also inclined so that the diverging channel, A, is lower than the body. B is the valve seat, and at C, in the diverging channel, are placed four button-shaped projections on which the ball rests until moved back by reflux water. It will be observed that, while the flow is passing from right to left, the ball is carried down into the channel, A, and there remains so that the water passes out directly through the main bore. The instant, however, a back current begins, then the water, entering the opposite and lower end of channel, A, drives the ball against its seat, B, so that it at once cuts off any return of water. The ball is intended to be of hollow rubber and is inserted through a hand hole.

Patented July 31, 1877. For further information address Hay & Bassett, 182 Fulton street, New York city, P. O. Box 4825.

SHERWOOD'S AUTOMATIC TEA AND COFFEE POT.

We illustrate herewith an improved apparatus for making tea and coffee. Its action is automatic, and may be regulated by a simple device which forms one of the novel features of the invention. The interior construction of a large-sized vessel adapted to the uses of hotels, etc., is exhibited in Fig. 2; but smaller pots are manufactured, as shown in Fig. 1, on the same principle, which are excellently adapted to family employment.

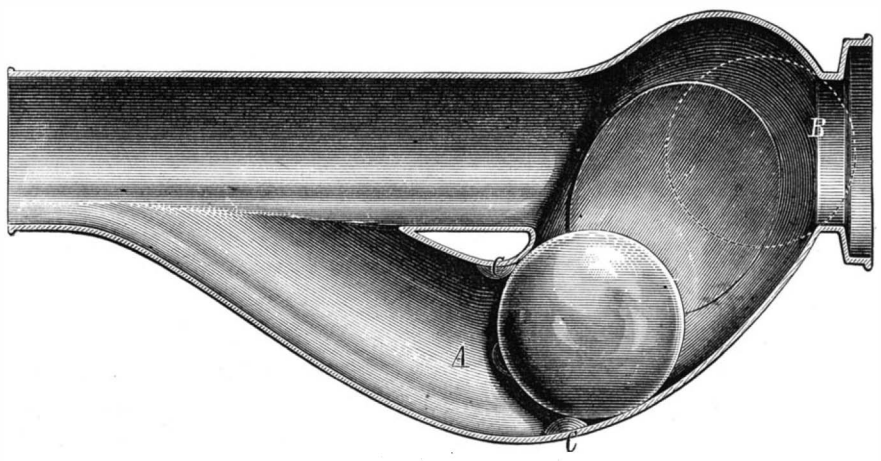
Fig 1



In common with other coffee pots in which the beverage is made by filtration through the ground berry, this apparatus has two principal portions—a water receptacle below and a detachable compartment above, in which the coffee is placed. The lower division is double, a receiver, A, for the made infusion being inserted in the water vessel, B. Communicating with the latter and extending up through the receiver and into the upper compartment, is a tube, C, having a detachable perforated cap. Surrounding the upper portion of the tube is a conical piece and another funnel-shaped portion, attached to the cover, surmounts the perforated cap. The bottom of the upper compartment, on which coffee is placed, is perforated, and below this is a ring on which a piece of flannel is stretched, said ring being detachably held in place by hooks.

When the water in the vessel, B, is boiled, the steam generated forces it up through the tube, C. Escaping at the upper end of said tube and being deflected downward by the conical portions, the water passes down through the coffee and sieves, and the infusion is collected in the receiver, A, whence it is drawn off as desired, by a faucet communicating with said receiver. Another faucet is provided for drawing the water in the outer receptacle, and in order to prevent access to these faucets by unauthorized persons, the handles of the same may be padlocked together, as shown in the exterior view of the apparatus in Fig. 1. The water pot is provided with a filling opening, which is closed by a cap with a spring safety valve, D, said valve being opened or closed by a set screw applied to its stem. On opening the valve, the steam in the boiler may be allowed to escape whenever it is desired to interrupt the coffee-making process. Also in connection with the receiver is a tube in which is a quadrated indicator, E, to which a float is attached, and which seems to show the quantity of coffee made. Heat may be applied directly to the water vessel, or a perforated tube, F, is inserted, which pipe from a steam generator may be attached, to facilitate heating by steam. When this pipe is not used it is closed by a screw cap. The object of making the upper portion of tube, C, detachable, is to allow of cleaning it out in case of its becoming clogged; and the flannel and ring filter may be removed for like purpose.

The smaller sized family pot, represented in Fig. 1, differs in construction from that described, in having, instead of the spring safety valve, a metal ball attached to the filling funnel by a chain. This prevents the escape of steam until a sufficient pressure is generated to lift it.



BALL CHECK VALVE FOR SEWERS.

Patented through the Scientific American Patent Agency, May 22, 1876, June 27, 1876, and July 10, 1877. For further information, address Willis H. Sherwood, patentee and sole manufacturer, St. Joseph, Mo.

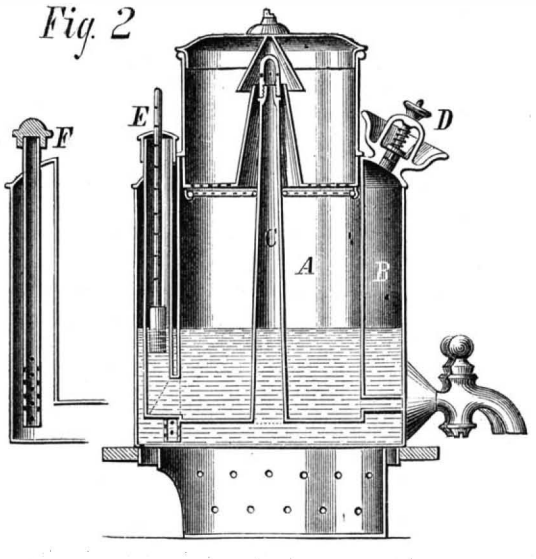
Water for Fire Extinguishment.

Several months ago the Metropolitan Board of Works, of London, directed Sir Joseph Bazalgette, in conjunction with Messrs. Bramwell and Easton, to carry out a series of practical experiments upon the question of fire jets, which should put beyond all doubt the engineering points involved. The result of these experiments is recapitulated as follows in a paper prepared by the last two engineers, and recently read before the British Association at Plymouth:

With a very low jet, say of some 30 feet, about seven eighths of the head or pressure effective at the orifice of the jet will be obtained, as the height of the column of water—that is to say, 40 feet of head at the orifice would give a jet of about 35 feet in perfectly still air; but as the heights of jets are increased, and increased they must be, if they are to be of any service in extinguishing fires in modern buildings, which are so lofty, the percentage which the column of water produced bears to the effective pressure producing it becomes less and less, so that for a jet to rise to the height of 80 feet there must be, roundly, a pressure equal to 128 feet. To rise to a height of 100 feet there must be an effective pressure of about 180 feet. Moreover, the higher the jet the greater must be the diameter of the column of water.

The following is a fair average jet required for London purposes: A jet that would rise 80 feet in still air, if of 1 inch in diameter, would deliver the 150 gallons per minute, and would demand an effective pressure, as has already been said, of 128 feet at the very orifice of the jet; and it might be thought, therefore, that if a pressure could be maintained in the pipes equal to 128 feet of head, when the water was flowing, that all that was desired would be provided. But this is not so. There is the very striking, and to many people very unexpected, consideration of the friction of the water through the hose to be taken into account; and the section may, perhaps, little expect to be told that every foot of the usual size of hose employed by the London Fire Brigade, when conveying 150 gallons of water per minute, requires a pressure of a little over 3 inches to drive that water through.

Fig. 2



SHERWOOD'S AUTOMATIC TEA AND COFFEE POT.

As a matter of fact, the 200 feet of hose demands 53 feet of pressure to get 150 gallons per minute through them. Therefore, to obtain a jet of 80 feet high, expending 150 gallons per minute at the end of 250 feet of hose, there is needed a pressure of 181 feet, and this pressure must be maintained while the water is flowing.

A Revolving Shell Gun.

A correspondent with the Turkish fleet writes: "In speaking of the armament of the Arsari Tefyk, I should mention that a most valuable addition has lately been made in the shape of a revolving shell gun. It is the invention of a Frenchman, and, in connection with the electric light, may be considered as the very best defence yet brought out against torpedo boats. It throws a one pound shell with a pointed steel head capable of piercing the plates of which the Thornycroft is constructed, and has a range of something like 3,000 yards. Briefly described, it is a Gatling gun on a large scale, having five revolving rifled barrels instead of ten, the said barrels being about 3½ feet in length, and 1¼ inches bore at the muzzle. The loading and firing arrangements are similar to the Gatling, only, instead of a cylindrical case being placed on top of the breech, the cartridges are arranged in flat cases of five, which are fixed in an inclined position at the side. The turn of a handle causes one of the cartridges to slip into the chamber, when it is thrust forward into the barrel and fired. This weapon is fixed on a pivot at the stern, while a Gatling gun at each end of the bridge, and one on the forecastle, are also always ready for giving a warm reception to any of the enemy's boats which may attempt to approach the Turkish flagship while at anchor.

IMPROVED NEEDLE CLAMP FOR SEWING MACHINES.

The advantages claimed for the improved needle clamp illustrated in the annexed engraving are that it fastens the needle without the aid of wrenches or screwdrivers, and as the hands are separated by the length of the needle-bar, more space is afforded for handling and adjusting the needle, sufficient force can be applied to clamp the needle securely by anyone, however weak in the hand or wrist.

Fig. 2

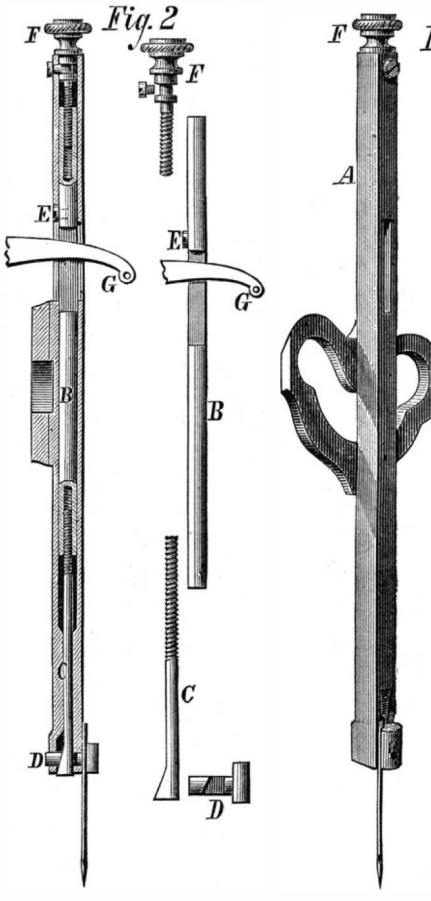


Fig. 1

A, Fig. 1, is the needle-bar, which is boxed longitudinally to receive the rods, B and C, Fig. 2. On the lower end of rod, C, is a wedge-shaped projection, which is fitted in a slot in the bolt, D, said slot being widest at its lower side. The bolt, D, has a head, and enters a hole bored transversely through the lower end of the needle-bar. The rod, C, screws into the rod, B, which is of larger diameter, and is provided with a screw, E, which passes through a slot in the needle-bar, to prevent it from turning. F is a milled screw that engages a thread cut in the upper end of the rod, B, and which is designed to draw the rods, B C, upward in the bar. The check lever, G, passes through a slot in the needle bar and rod, B, and is regulated by screwing the rod, C, more or less into B.

The operation of clamping the needle consists in placing it under the head of the bolt, D, and turning the screw, F, until said head is drawn by the action of the wedge against the needle with sufficient force to retain it.

Patented through the Scientific American Patent Agency May 29, 1877. Parties desiring to manufacture or adopt the device may address the inventor, Mr. Joseph V. Morton, Winchester, Clarke county, Ky.

Carrier Pigeons as Smugglers.

Carrier pigeons have recently been used in France to smuggle tobacco over the border. One individual employed eighty birds, each one carrying from a third to a half ounce of tobacco as its load per trip. It happened that one of the pigeons became injured and fell into the Seine near Paris, and on its being picked up, the fraud was discovered.

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THE WOODRUFF SCIENTIFIC EXPEDITION STEAMER ONTARIO.

We present herewith an engraving of the steamship Ontario, in which, we are informed, the Woodruff Scientific Expedition is to embark during October next, on a voyage around the world. The Ontario is 390 feet long, 46 feet wide, and 40 feet deep; and is to be provided with all the accessories necessary to secure the comfort of her passengers, and to adapt her for the especial objects in view. Saloons, it is stated, are to be arranged for lecture rooms, etc., a library is to be furnished, improved ventilating apparatus will maintain a constant supply of fresh air between decks, and scientific instruments will be supplied for the investigation of all natural products and phenomena that may be deemed desirable. The projectors of the expedition, Messrs. Woodruff and Macauley, also state that the ship will be navigated by Commander J. W. Philip, U.S.N, aided by naval officers and a crew of picked seamen.

As we have already had occasion to state, the object of this expedition is to visit points of general and special interest on a route around the globe, to study the arts, archæology, and present condition of the better known countries, and the geology, geography, fauna and flora, as well as the history and character of the people of those less known, and to make collections in the various departments of the science. The scientific work is, we are further informed, to be under the supervision of Professor Burt G. Wilder, Cornell University, aided by other scientific gentlemen now belonging to various colleges. From the itinerary in the prospectus, we learn that the route is to be along the Atlantic coast of North and South America, stopping at the West Indies and other important points, and reaching Magellan's Straits in December. Thence the journey will extend to Valparaiso, and from thence the course will lie to the islands of the Pacific—Japan, Shanghai, and Nankin. During this portion of the voyage, and while the ship is visiting China and Japan, a portion of the passengers are to explore the Islands of Formosa. Hong Kong, Canton, Manilla, Borneo, Java, and Calcutta will be visited, and thence the expedition will proceed in succession to Ceylon, Bombay, Babylon and Nineveh, Egypt, the Holy Land, Greece, Italy, and Spain. At all comparatively unknown stopping places, it is proposed to organize exploration parties, and facilities are to be afforded for visiting inland cities in civilized countries. The vessel is to leave Plymouth, England, in 1879, and to return thence to New York *via* the Azores Islands. The total cost of the trip is to be $2,500. Further particulars as to terms of payment, etc., may be obtained by addressing Gen. Daniel Macauley, St. Nicholas Hotel, New York city. See advertisement in another column.

HOW TO PREVENT GRASSHOPPER RAIDS.

Professor C. V. Riley, in his new book on the Rocky Mountain locust, gives a number of practical hints as to the best method of preventing incursions of the insects into States other than those now annually invaded. The various suggestions we have condensed into the following brief form:

1. Encourage game birds and native locust-feeding species.

2. Professor Thomas suggests that inducements be offered to the Indians to collect and destroy the eggs and young along the west side of the plains.

3. Some system is wanted for preventing the extensive prairie fires in the fall that are common in the country where the insect naturally breeds, and then subsequently firing the country after the young hatch, and before the new grass gets too rank.

4. Locusts are particularly fond of tansy, cocklebar, amarantus, and timothy—these might be sprinkled with Paris green water or powder. A strip of poisoned timothy around a wheat field might save it.

5. Irrigation is the best preventive; inundate the land and drown the young locusts out after hatching, or use kerosene in the ditches.

6. Hogs and poultry delight to feed on the young hoppers and will grow fat on them.

7. When, in the spring, the young locusts hatch out in threatening numbers, delay the planting of everything that cannot be protected by ditching until the very last moment. The idea is to let the locusts devour all they can find and then to let them starve before any crops grow for them to feed on.

8. Grain should be sown in "lands" or strips 50 to 100 feet wide, to permit of ditching between them, and those who have fall wheat up and doing well, where the eggs are thickly laid, should make ditches at intervals through the field, to facilitate the saving of the grain in the spring.

9. As the disastrous swarms which reach the southeastern country come from the extreme northwest, it is proposed that the number of United States signal stations be increased in that region. The movements of swarms might thus be daily recorded, and the farmers of the east and southeast be apprised of their probable coming for weeks in advance.

10. Professor Riley thinks that the army might "be utilized to destroy locusts instead of Indians. A few regiments," he says, "armed with no more deadly weapon than the common spade, sent out to sections of country that are suffering from locust ravages, might in a few weeks measurably rout the pigmean army, and materially assist the farmer in his ditching operations."

Cleansing Fluid.

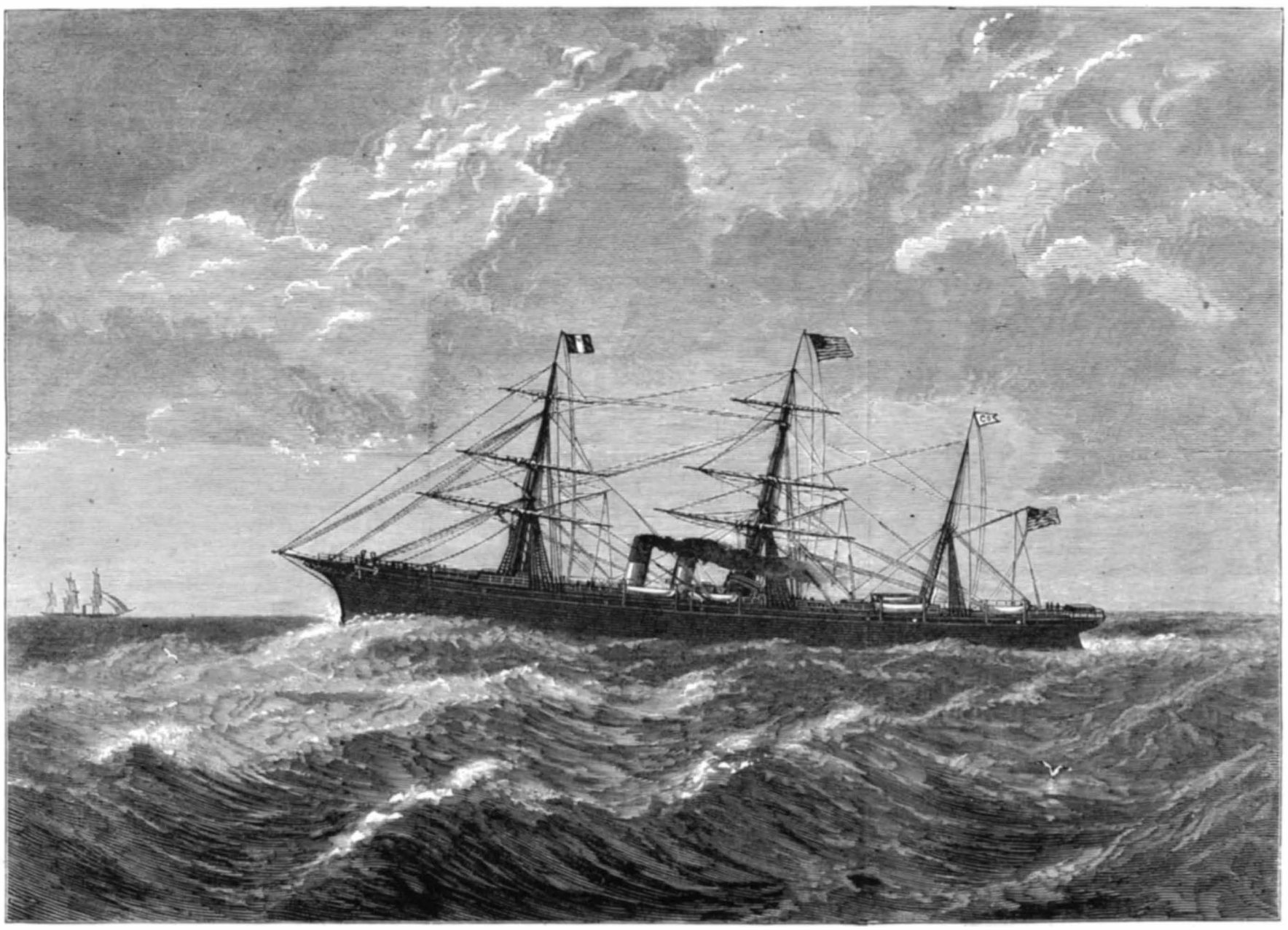
For washing alpaca, camel's hair, and other woolen goods, and for removing marks made on furniture, carpets, rugs, etc.: Four ounces ammonia, four ounces white Castile soap, two ounces alcohol, two ounces glycerin, two ounces ether. Cut the soap fine, dissolve in one quart water over the fire, add four quarts water. When nearly cold add the other ingredients. This will make nearly eight quarts and will cost about 75 cents. It must be put in a bottle and stoppered tight. It will keep good any length of time. To wash dress goods, take a pail of lukewarm water, and put in a teacupful of the fluid, shake around well in this, and then rinse in plenty of clean water, and iron on wrong side while damp. For washing grease from coat collars, etc., take a little of the fluid in a cup of water, apply with a clean rag, and wipe well with a second rag. It will make everything wooden look bright and fresh.—*Chicago Tribune.*

The Formica Pennsylvanica.

There is a general notion that only tropical countries are infested with ants that are capable of doing serious damage. This, it appears, is a mistake. There is a black "carpenter ant," whose name, *Formica Pennsylvanica,* indicates its residence, that is capable of effecting much destruction in woodwork. The Rev. Dr. McCook has seen a rafter which these ants penetrated to an extent of five or six feet of its length, completely honeycombing it. The rafter was in the roof of a porch. The attention of the Philadelphia Academy of Sciences was called to the matter, as it is evident that such penetration of wooden structures, and especially bridges, might cause their unexpected fall. Wooden bridges need at least as frequent and as thorough inspection as iron structures.

CEMENT FOR LEATHER BELTING.—Take common glue and American isinglass, equal parts; place them in a boiler and add water sufficient to just cover the whole. Let it soak ten hours, then bring the whole to a boiling heat, and add pure tannin until the whole becomes ropey or appears like the white of eggs. Apply it warm. Buff the grain off the leather where it is to be cemented; rub the joint surfaces solidly together, let it dry for a few hours, and it is ready for practical use; and if properly put together, it will not need riveting.

PUT a tablespoonful of sulphur in the nest as soon as hens or turkeys are set. The heat of the fowls causes the fumes of the sulphur to penetrate every part of their bodies, every louse is killed, and, as all nits are hatched within ten days, when the mother leaves the nest with her brood, she is perfectly free from nits or lice.



THE WOODRUFF SCIENTIFIC EXPEDITION AROUND THE WORLD.—THE EXPEDITIONARY STEAMSHIP ONTARIO.

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THE LONTIN MAGNETO-ELECTRIC MACHINE.

We extract from *Les Mondes* the annexed engravings of a new dynamo-electric machine, made by MM. Lontin & Co. of Paris. Two forms of the apparatus are manufactured, one giving direct and continuous currents, and hence adapted for galvano-plastic operations; the other affording alternating currents for the production of the electric light.

Fig. 1 represents the continuous current machine, which is composed of an ordinary electro-magnet, A A′, before the poles of which turns the piece, P, called "induction wheel." This wheel is composed of an iron cylinder on which are formed iron teeth, or induction coils enveloped in copper wire, D. The wire which forms the coils is continuous, passing on from one tooth to another, so that a completely closed circuit is formed. The currents produced in each coil are united at a single point, C, on the axis of the cylinder, whence they pass to the immovable conductor wires, *a a*, placed perpendicular to the line, X X, of the magnetic poles.

The induction wheel, P, being rotated, the residual magnetism of the electro-magnet, A A′, produces feeble currents in the coils, which currents are conducted by the wires, *a a*, to the electro-magnet, the energy of magnetization of which increases in ratio of the production of these particular currents. The line, X X, of the magnetic poles, divides the coils on the wheel into two equal series, five above and as many below. Now, if the electricity furnished by the upper coils is of contrary name to that furnished by the lower ones, then there will be on the line, X X, on one side a double pole of positive electricity, and on the other a double pole of negative electricity; and if contact be established on this line by means of two copper wires, there will be the two poles of one electrical source. This will be more clearly understood by imagining (as indicated in Fig. 2) two batteries, each of five elements, connected by their poles of the same name. This would evidently produce a battery of five elements in tension and two in quantity.

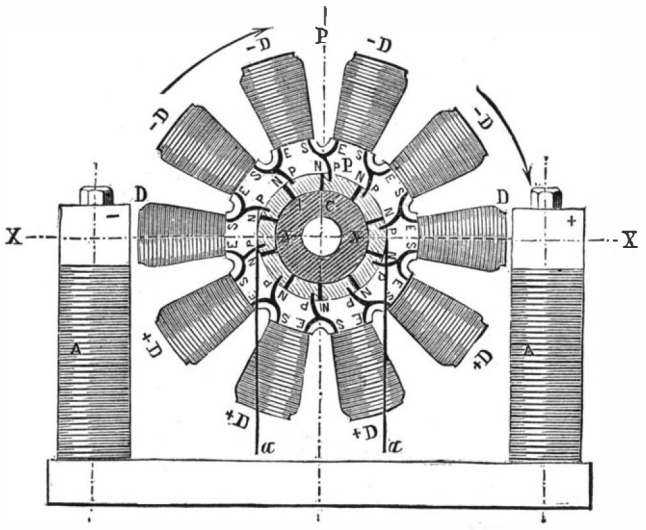
By using all the electricity produced to excite the magnetic energy of the electro-magnet, the radius acquires so high a resistance to rotation, that it is scarcely possible to move it without causing injury. But if, breaking the circuit, work to be done is interposed (a galvano-plastic bath for example), the machine operates excellently, and, according to *Les Mondes*, gives good results.

The alternating current machine, especially adapted for the production of the electric light, is represented in Fig. 3. It consists of 24 inducing electro-magnets, A, fixed on a shaft, and concentric with the same number of coils, B, attached within an iron ring, *b b*. The wires which envelope the inducing electro-magnets are connected so as to form but a single circuit, the extremities of which are attached at *f* to two friction rings, *a a*, attached on each side of the drum and completely isolated. The attachment of the wires is so disposed that, inverting the polarity of the cores from one bobbin to the other, the rotation of the drum presents successively a magnet of different pole before the cores of the induced coils, whence result, in the latter, polarizations alternately reversed.

The current which circulates in the inducing electro-magnets of the drum, is produced by a small auxiliary machine, similar to that above described. It enters by the rubbers, F, to which are attached the wires which form the circuit of the auxiliary machine. The circuit produced by all the inducing coils of the drum may be divided proportionately to the current obtained in the auxiliary apparatus. The wires which surround the induced cores, B, terminate the one at the manipulator, M, the other at N.

The manipulator is divided into as many parts as the machine can furnish currents capable of producing a light, and this number naturally depends on the number of induced bobbins. Thus, in a 24 coil machine, twelve currents may be produced, as two coils are required for each current. There are, therefore, twelve partial manipulators, each comprising two binding keys, M M′, one of which, M, receives the wire from the machine, the other the wire which leads to the lamp regulator; the interrupter, I, interrupts or re-establishes the passage of the current between these two wires. All parts of the manipulator are, besides, provided with interrupters which connect said parts together so as to produce instantaneously the coupling or separation of the partial currents. Thus, with a 24 coil machine, twelve lamps may be supplied, and then, on eleven being extinguished, the one remaining continues with no variation. At the same time, by means of the interrupters, the currents may be concentrated in one or more lamps, so that each may have double, triple, or quadruple intensity, as desired.

The entirely novel application which M. Lontin has made on his regulator, of the dilatation of a metallic wire by the heat produced by the passage of the current in order to obtain the separation of the carbons and to maintain the same rigorously constant, has enabled him to avoid the use of electro-magnets (the resistance of which, interposed in the circuit, was the cause of a notable increase in expenditure of electricity) and to regulate with accuracy the length of the arc. The approximation of the carbons is obtained by a resistance coil which contains an easily movable rod which acts as a stop for the motor which brings the carbons together for the proper distance. If, however, the separation augments, part of the current passes into the core and renders it active. The movable rod is then drawn back, and the motor, freed from its stop, operates to move the carbons forward until the correct interval is attained. The solenoid then ceases its work, and the rod again stops the motor. The latter having nothing to do but to move the carbons is exceedingly simple. It is of no consequence how the regulator is placed, as it works well in any position. The editor of *Les*

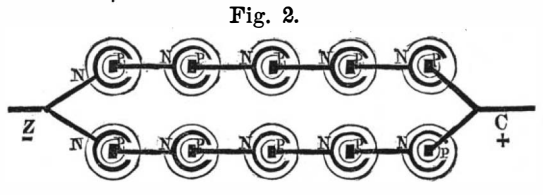


NEW ELECTRICAL MACHINE.—Fig. 1.

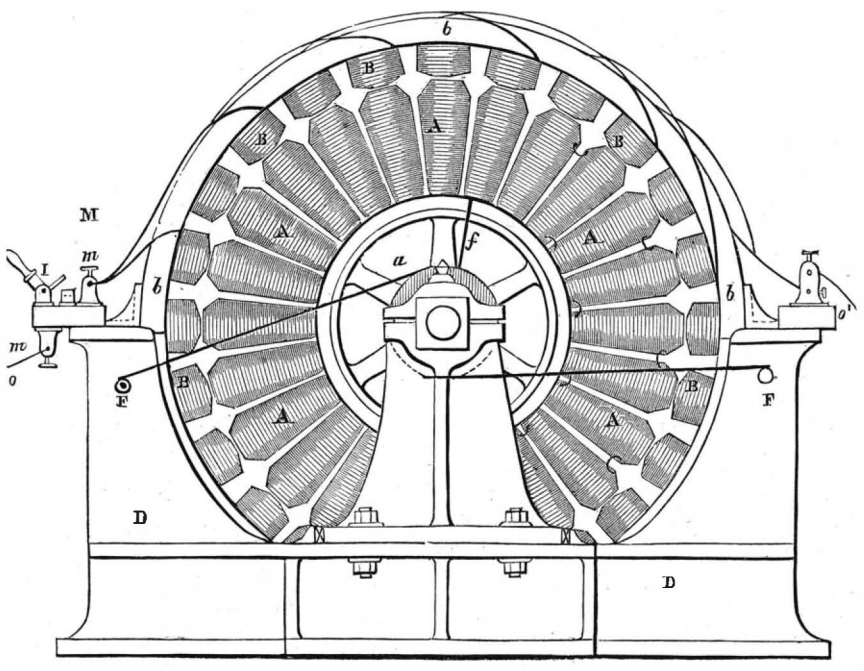
Mondes states that it operated with perfect uniformity when suspended from a cord, swung about, and subjected to violent shocks.

The machine, says our contemporary, has been tested under a variety of conditions. Aboard ship one single apparatus is capable of supplying the three electric lights usually carried, and it is unaffected by any motion of the vessel. For lighthouses, instead of using two carbons, through

Fig. 2.



which all the current passes, M. Lontin employs several, radiating one from the other, and in number proportioned to the power of the currents produced by the machine. Each carbon receives two currents, and these currents pass from one carbon to the other, so that the arcs are produced laterally. Thus, with a machine of 1,240 burners, six carbons are used, so that six arcs, equal to 200 burners each, are employed, forming a hexagon of light. This disposition has the advantage of affording a more powerful light, and at the same time one perfectly fixed.



MAGNETO-ELECTRIC MACHINE.—Fig. 3.

The apparatus represented in Fig. 1 may also be used as an electro-magnetic engine. If a current be passed into the electro-magnet, A A′, and thence to the induction coils on the wheel, the magnet will have two poles of opposite name, and in the coils the two halves will also be oppositely magnetized. So that, the five upper cores, for example, constituting the negative pole, the five coils below will form the positive pole. The negative pole, A, of the electro-magnet will then replace the upper negative pole of the wheel, while the latter will be attracted by the positive pole, A′, of the electro-magnet. The effect will be the same below, and a rotation of the wheel will be caused. We find it stated that a single machine, of the size mentioned in the beginning has been applied to the production of a fine light and at the same time has lifted a weight of 42 lbs. by means of a pulley.

AMERICAN BORAX PRODUCTION.

The principal industrial utilization of borax is in glass making and the ceramic arts, as it possesses the property, at a high temperature, of dissolving the metallic oxides and forming transparent glass, the color of which depends upon the metal used. It is also largely employed in the manufacture of enamels, glazings for earthenware, and strass. In the large glass and porcelain factories of Europe its utilization has only been limited by the high cost of the product, chiefly obtained from Italy; but the discovery of the immense borax deposits in our western territory has materially removed this restriction, so that at the present time its employment is rapidly extending, and the export of the salt from this country bids fair to become a very important branch of our commerce.

Some interesting information relative to the mode of working the borax deposits of California and Nevada is given in a report recently made by Mr. Emile Durand, who has had several years experience in the extraction of the material, to the French Society for the Encouragement of the National Industry. The various compounds of boric acid commonly found are the borate of soda, various borates of lime, hayesine or ulexite, cryptomorphite and datolite. Tourmaline may be added to this list, although it is quite rare, except in the tin mines of San Jacinto, where it forms the gangue of the ore.

The principal deposits form a kind of band in the ancient volcanic soil, which surrounds the Sierra Nevada at the north and east. This region is rich in hot springs, some sulphurous, and containing in solution in their waters various salts. The borax, which is found in the saline deposits of the valleys, may have been produced by one of two causes, either by deep springs containing boric acid or borax in solution, or by the surface water of a vast basin accumulating in a reservoir and there concentrating over an unknown period. The second hypothesis is considered as the most probable, as the salts which accompany the borate of soda (sulphate, chloride, and other magnesia salts) are found in large quantities in the adjacent mountains.

The borate of lime found in these deposits is formed probably by double decomposition. It appears in crusts on the surface or in masses in the soil. The latter are of all sizes, sometimes weighing over four pounds and containing the borate in long silky filaments, or in an amorphous powder mixed with sand and soda salts. When obtained at the surface the borax is in small crystals, yellowish white in color. It has a slightly sweetish and quite agreeable taste, which is probably owing to organic matters, as it disappears after the refining. A thin steel shovel with a sharp edge for cutting the herbage is used for collecting the salt, which is taken in carts to a platform placed above large wooden vats capable of containing some 3,500 gallons. These vessels are filled with water, heated to boiling by the injection of steam. The borax is thrown in by shovelsful until the areometer marks 23° B. This concentration would be too great if only borax were put in, but the impurities (sulphate of soda and rock salt) added, besides the mud and borate of lime in suspension, greatly augment the density. When the above degree is reached, the solution is allowed to rest, the herbage which floats on the surface is skimmed off, and the liquid is carried by long india rubber tubes into the crystallizing vessels. The latter are large tanks 9 feet 6 inches in length, about 6 feet high and 39 inches wide. The liquid cools slowly to a temperature of 77°, occupying about ten days in so doing. A faucet at the lower part of the tank is then opened, and the mother liquor, mud, and large borax crystals which are formed by aggregations of small crystals are removed. These crystals are washed with the mother liquor in another vessel, by agitating them with a rake in a long trough filled with water. They are afterwards kept for refining.

At the bottom of the crystallizing vat is found a deposit of borax sometimes 6 inches in thickness, which is broken up with the pickaxe. The salt is then left to dry on platforms for four or five days, and finally is packed in coffee sacks, the filled bag weighing 165 lbs.

The distance from Columbus, Nevada, the site of one of the principal deposits, to Wadsworth, the nearest station on the Central Pacific Railroad, is about 360 miles over a desert country. The means of transportation is a train composed of three wagons, the pole of one fastened in the axle of the preceding. Twenty-four mules are harnessed to the first wagon. In this way the load of about 30 tons is distributed on the six axles, an important precaution, as the route lies over sandy plains and marshes, where roads are unknown. When a difficult place is reached, the three wagons are separated and the whole force of mules is attached to one vehicle at a time, which is thus hauled over or through the obstacle. Generally the owner of the train conducts it, aided by one or two assistants, and in the last wagon is stored the necessary provision, which includes both food and water, for

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men and animals. This journey adds about 1½ cents to the cost of the borax per pound. From Wadsworth to San Francisco the expense of transportation is 1½ cents, and from the latter point to New York it is stated to be 1½ cents additional a pound. The total cost per pound in San Francisco is about 8½ cents. The monthly production of borax in California and Nevada is estimated at 200 tons.

FRAUDULENT USE OF BENZINE.—Benzine is frequently substituted for and mixed with turpentine by unprincipled dealers, but it is far inferior to turpentine for mixing paint.

NEW BOOKS AND PUBLICATIONS.

PERSONAL APPEARANCE AND THE CULTURE OF BEAUTY. By Dr. T. S. Sozinskey. Philadelphia: Allen, Lane, & Scott, Publishers, 233 South 5th street.

Contains chapters on types of male and female beauty which give measurements so that anybody *in puris naturalibus* posted before a mirror, tape line in hand, can soon discover whether his or her proportions come up to the standard here set forth. That done, the reader can compare each of his or her features in turn with the ideals described in the successive chapters devoted thereto, and at the same time he or she will get some probably useful ideas as to how to improve portions which are not strictly beautiful. The author offers some suggestions as to dress and in general labors to convince his readers that "the proper study of mankind is man."

THE METALLURGICAL REVIEW. Published by David Williams, 83 Reade street, New York city. $5 per year.

No. 1 of this new magazine has recently been issued, and we are told that it is to be devoted exclusively to the literature of metallurgy. Professor R. H. Thurston begins the initial number with a treatise on the mechanical treatment of metals; then follows the first of a series of papers by Mr. E. C. Pechin on the New Iron District of Ohio; Siphon Tap in Lead Smelting, by C. Kerchhoff, Jr.; on Steel by W. Metcalf, C.E., besides other valuable articles. We can compliment the publisher on the very handsome dress in which the magazine is presented.

THE LOCUST PLAGUE IN THE UNITED STATES. By Charles V. Riley, Ph.D. State Entomologist of Missouri, etc. Illustrated. Published by Rand, McNally & Co., Chicago, Ill.

A number of Professor Riley's admirable papers on the grasshopper scourge have appeared in this journal, so that our readers are already familiar with the comprehensive and lucid manner in which this and other entomological subjects are treated by him. In the present work, the various articles which have been published by the author in Missouri entomological reports and elsewhere, relating to the Rocky Mountain locust, are collected in compact form, and as all are based upon an extensive personal experience and long study, the work may be pronounced as invaluable to agriculturists whose crops are yearly invaded. The book is copiously illustrated and colored maps are given, showing the territory devastated or visited by the locusts during different years. There is a full discussion of all the practical ways and means for the prevention of locust injuries; and also of the various legislative enactments calculated to encourage the extermination of the insect.

Inventions Patented in England by Americans.

From August 7 to August 21, inclusive.

BALL VALVES.—B. C. Hay, Washington, D. C.
BOXES FOR SHAFTING, ETC.—J. Tomlinson, Black Hawk, Cal.
CIGAR HOLDER.—E. S. May, Campbelltown, N. Y.
COMPRESSED AIR APPARATUS.—E. Barr, New York city.
ENAMELLED IRON.—S. C. Quimby *et al.*, St. Louis, Mo.
ENVELOPES.—C. K. Marshall *et al.*, Vicksburg, Miss.
FASTENINGS TO ROPE, ETC.—J. K. Lake *et al.*, Chicago, Ill.
ICE-MAKING MACHINERY.—A. Albertson, Hudson, N. Y.
LUBRICATING AXLES.—W. Y. Selleck, New York city.
MUSIC STAND.—J. F. Walters, Boston, Mass.
PAPER.—W. A. Miles, Copake, N. Y.
POSTAL CARDS.—C. K. Marshall, Vicksburg, Miss.
PREPARING FOOD.—C. Morfitt (of Baltimore, Md.), London, Eng.
PREPARING HAY.—J. B. Lafitte, New Orleans, La.
PREVENTING INCRUSTATION IN BOILERS.—R. H. Harcourt, Chicago, Ill.
PROPULSION OF CARS.—W. Eppelsheimer, San Francisco, Cal.
REFRIGERATORS.—A. W. Zimmerman, Dayton, Ohio.
STEAM MOTORS.—E. H. Angamar, New Orleans, La.
STUFFING HORSE COLLARS.—B. F. Grayson, Jr., Luray, Va.
TREATING HAIR, ETC.—J. F. Green, Brooklyn, N. Y.
TREATING WOOD.—L. S. Robins, New York city.
WOOD SCREWS.—R. Boeklen, New York city.

Recent American and Foreign Patents.

Notice to Patentees.

Inventors who are desirous of disposing of their patents would find it greatly to their advantage to have them illustrated in the SCIENTIFIC AMERICAN. We are prepared to get up first-class WOOD ENGRAVINGS of inventions of merit, and publish them in the SCIENTIFIC AMERICAN on very reasonable terms.

We shall be pleased to make estimates as to cost of engravings on receipt of photographs, sketches, or copies of patents. After publication, the cuts become the property of the person ordering them, and will be found of value for circulars and for publication in other papers.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED CAR COUPLING.

James Rockwill, Ponca, Neb.—This invention refers to an improved car coupling of that class of couplings which are self-coupling on the approach of the cars, without requiring any one to step in between the same for holding the link; and the invention consists of the arrow-shaped draft hook of one drawhead coupling with fulcrumed hook-shaped jaws of the opposite drawhead, the lower jaw being extended to the rear of the drawhead, and locked by a pivoted and weighted catch into open or uncoupled and closed or coupled position. A loop-shaped lever extends backward through the rear end of the drawhead to admit the throwing forward of the draft hook for coupling, or the drawing back of the same within the mouth of the drawhead whenever it is not desired that the cars should couple. When the draft hook is thrown forward the draft hook, link, and wire loop are securely retained in line and prevented from swinging back into the drawhead. The catch block retains the coupling jaw either in locked position, so as to produce the reliable interlocking of jaws and draft hook, or supports the lower jaw in open and uncoupled position, until, by the entrance of the draft hook, the catch block is released by the raising of the rear end of the lower jaw, and the weighted rear end dropped, and the heel of weighted catch block thrown into the recess of the rear end, so as to rigidly lock thereon.

IMPROVED SAFETY VALVE.

Erastus B. Kunkle, Fort Wayne, Ind.—This invention has relation to safety valves for steam generators, and especially to valves which have applied to them means for preventing them from being tampered with by improper persons. The tubular box or body of the instrument is enlarged above and contracted below, and constructed with a male thread cut on its lower end, and a number of holes in its largest end, to receive a spanner for screwing it into place on a boiler. A screw thread is also cut on the upper end of the body to receive a perforated cap, which is held fast by a small set screw. In the center of the cap is a tubular hub, which is screw-tapped inside part of its length, and tapered outside below the top of the cap. Above the interior threaded portion of the hub is a chamber, into which a nut is applied, receiving inside of it a screw. A cone-pointed screw is screwed into the hub, so as to bear centrally on a flanged cup. This screw is grooved to receive the feather on the inside of the barrel of a key, by means of which key and a lever the screw can be turned, and a helical spring compressed more or less, as may be required. After this adjustment a soft metal cap or seal is stamped upon the perforated head of the screw, and the latter locked by means of the jam nut. The top of the cover is slotted for the escape of steam during an alarm, and concentrically cast on the bottom of the cover is another flange, which laps over the largest part or upper end of the valve, and shuts off communication between the interior of the cap and the long spring chamber of the valve, thus excluding everything injurious from the spring chamber.

IMPROVED GRAIN DISTRIBUTER.

Cornelius E. Drake, Avoca, Iowa, assignor to himself and John S. Murray, of same place.—This invention relates to an improved grain distributer for elevator heads, by which any scattering of grain is avoided and the same delivered to as many bins as desired. It consists of a distributer with radial spouts and of an interior revolving cylinder with dishing bottom, having exit apertures of a size corresponding with the spout openings. A cylindrical casing or receptacle is provided with any desired number of inclined bin spouts, radiating at the lower part from the same. The casing is secured to the elevator head, and leaves no room for scattering grain. To the interior of the casing is fitted a revolving cylinder, having inclined or dishing bottom, forming a spout-shaped aperture that registers with any one of the bin spouts. The bottom is operated by the ordinary index rod, that is attached to the center of the bottom. The connection of spouts and casing with the tightly fitting discharge cylinder prevents the scattering of the grain, and furnishes a stronger, more durable, and cheaper distributer than those at present in use. The spouts are secured to the grain-delivering tubes and the adjustable bottom set to any one of the spouts, as required. The distributer is secured by a top flange to the elevator box, and serves in effective manner for the purpose for which it is designed.

IMPROVED CIRCULAR SAW.

Donald B. McRae, Bay City, Mich.—The object of this invention is to provide for renewing the teeth of large saw plates in a manner not subject to the objections attending the use of what are known as "insertable teeth." The invention consists of a sectional or solid toothed ring attached to the periphery of a plate or disk forming the body of the saw, the ring being "halved" on to the plate when made solid, and tongued and grooved when made in sections, and being riveted in both cases. In practice, the saw plate will be the same thickness at the center as the toothed ring, but will taper or diminish slightly therefrom to the inner edge of the ring, so that the friction will be less than it is in other saws in which the plate is the same thickness from center to periphery. This is an advantage that is made possible by this arrangement of an attached toothed ring, and cannot be had in the common saws, as they cannot be ground in such forms.

IMPROVED TIDE WHEEL.

Walter H. Andrews and Hiram Fuller, Deckerville, Mich.—This invention consists of a wheel placed on a vertical shaft and provided with buckets that open and close by the action of the current. The wheel is journaled in a frame that may be raised out of the water, and a gate is provided for regulating the motion of the wheel. The wheel consists of the heads that are secured to the shaft and the wings that are pivoted between the heads. The operation of the wheel is obvious. It is submerged in the stream and held in place by piles of timbers; and the gate being more or less open, the water spreads the wings and turns the bucket, so that all upon one side of the shaft are acted upon by the current, while upon the opposite side they automatically close or fold together, so as to offer no resistance to the current.

IMPROVED SAW.

Christopher J. Wilson, Macon, Ga.—The object of this invention is to furnish saws which will run easier, and cut faster and smoother than ordinary saws, which may be made of any desired size or kind, and will be applicable to any desired kind of work. The invention consists in constructing a saw with cutting teeth, each of which is beveled on one entire side or face from base to point, which are vertical on one edge and inclined on the other to the length or radii of the saw, according as it is a reciprocating or circular saw. The invention also consists in combining with these cutting teeth clearer teeth, which are of less length, but placed in line with the saw plate, and have a vertical and inclined side, similarly to the cutting teeth. In filling a cutting tooth, very little skill is required, since the file is laid flat against the beveled side, with its lower edge resting upon the inclined edge of the next tooth, which thus serves as a guide.

IMPROVED ROTARY VALVE FOR COMPOUND ENGINES.

Isaac Munden, Bradenville, Pa.—This invention consists in the arrangement of a hub carrying a circular valve that is made in three divisions. The casing of the said valve is provided with four ports, which admit steam into two cylinders, and with two ports connecting with a reversing valve. The object of the invention is to provide a valve that will admit steam to first cylinder in the engine at the boiler-pressure throughout its entire stroke, and conduct steam from this cylinder to the auxiliary cylinder, and from thence to the exhaust passage of the valve casing. The advantage claimed for this invention are, its economy in the use of steam, the facility with which the engine may be reversed, and its simplicity and compactness.

NEW HOUSEHOLD INVENTIONS.

IMPROVED BED BOTTOM.

Frederick P. Edmans, Troy, N. Y.—This invention consists in looped C-shaped springs fixed to and overhanging the head and foot crossrails, in combination with angular hooking blocks fixed to the slats. The free looped ends of the springs are adapted to receive and engage with the beveled ends of angular blocks, which are notched longitudinally and rigidly secured to the bottom of the slats near the ends thereof. The blocks are adjusted on their slats in such relation to the overhanging looped ends of the springs, when the rails are fixed in their places, that the blocks will firmly hold their places without rattling. This is a substantial and cheap bed bottom, which can be easily taken to pieces and put together, and which can be packed away in a very small space.

IMPROVED WASHING MACHINE.

Michael B. Nauss, Goldsborough (Etters P. O.), Pa.—The object of this invention is to furnish an improved washing machine, which shall be simple in construction, convenient in use, and effective in operation, washing the clothes with a rolling, rubbing, and squeezing movement, which may be manufactured at small cost, and which may be used in an ordinary wash tub. The machine is designed to be attached to an ordinary washtub, so that it will not be necessary for the purchaser of a machine to buy also a large tub or box to put it in. The invention consists in washing clothes between two corrugated boards or rubbers made in strips or sections, and the sections moving at different rates of speed and different distance, and the devices for so moving the several parts as set forth.

IMPROVED CARPET FASTENER.

Jesse Failing, Umatilla, Oregon.—This invention has reference to a simple and durable device for fastening carpets along the base board of the room, and taking them up with great facility, the carpet presenting, by the use of this fastening, a smoother and neater surface than when fastened by the common tacks; and the invention consists of a metallic rod running along the base board, and having the edge of the carpet placed around the same and pressed down on studs or pins driven into the floor in front of the rod, which is finally retained by grooved eccentric buttons or cams bearing on the rod. An iron rod runs along the base board of the room to be carpeted. In front of the rod are driven, at suitable distances from each other, wire pins or studs that project nearly up to the level with the top of the rod. Buttons or eccentrics are screwed to the base board above the rod, two or three feet apart, the buttons being made in the shape of eccentric cams, with a grooved or concaved circumference to fit over the metallic rod. The edge of the carpet is folded around the iron rod, pressed down over the pins, and the eccentric buttons are then brought down on the rod by pressing on the levers of the same until the rod and carpet are rigidly and evenly retained along the entire base board of the room. The carpet may be readily taken up by releasing the buttons from the rods and removing them, admitting thus the convenient laying down and taking up of carpets, and furnishing a superior and neater fastening than the common tacks in general use.

NEW MISCELLANEOUS INVENTIONS.

IMPROVED WHIP.

Frank Hopkins, Helena, Montana Territory.—This invention has relation to whips, and the nature of the invention and improvement consists mainly in a snap ring linked to a swivel, which is applied to a ferrule on the end of the whip stock. The whip staff or handle, on which is screwed a ferrule, has a short tube rigidly secured into one end, so as to form a shoulder for the spherical head of a swivel. The swivel consists of a spherical head, a cylindrical spindle or stem, and a ring or link. A snap ring is linked to the swivel, and designed to receive the loop of the whip lash. This ring is constructed with a pivoted section or tongue, held shut by a spring, thus allowing the lash to be quickly applied to, or detached from, the ring. It will be observed that the swivel and snap ring afford a safe and durable attachment for the whip lash, and allow perfect freedom of motion thereto.

IMPROVED FIRE ESCAPE.

Benjamin F. Frank, Colfax, Cal.—The object of this invention is to utilize the slats of a bedstead for a ladder, by means of which persons can escape from the upper stories of a burning building should other means of escape be cut off. The nature of the invention consists in a ladder which is composed of slats connected together by strong ropes, and provided with crosspieces, which are secured at proper intervals apart, and adapted to serve as foot-rests and hand-holds. They should be made sufficiently strong to sustain the weight of several persons, and they may be made of any desired length. The ends of the slats are all connected together by ropes, which are, preferably, passed twice through the ends, and prepared by tarring, so that they will be very strong and durable. To increase the strength of the slats at their ends, and prevent them from splitting when subjected to strain, metal plates are inserted into the ends. For the purpose of affording foot and hand holds, crosspieces are secured to the slats at suitable distances apart. These crosspieces are not in the way when the slats are arranged in a bedstead. On the contrary, they serve to space the slats and hold them in their proper places. When the slats are used for a ladder they are suspended from a hook made fast in the building wall, just below a window sill, and for this purpose a hole is made through the end of the topmost slat to receive the hook.

IMPROVED QUILTING MACHINE.

John J. Crall, Dry Ridge, Mo.—This invention has for its object to manufacture quilts in rapid and convenient manner by means of a sewing machine, running over the fabric stretched in suitable manner. The belt connecting the differential pulley shaft with drive shaft is transferred from a larger to a smaller part thereof, in order to produce a faster feed, and the reverse to get a slower feed. When the carriage has reached the end of its movement the differential pulley is unclutched from the shaft and the carriage run back by hand. For quilting with the machine, the fabric is first wound upon the back roller, the front roller being placed by hand levers close to the needle of the sewing machine. The upper nuts are then screwed down to hold the quilt and roller to the bed plate of the sewing machine, the latter being then passed over the fabric from right to left while the first line of stitches is being made. The fabric is then moved forward by the hand lever as far as required for the next line of stitching, and the sewing machine is run over the fabric as before. The quilted portion is then rolled up on the front roller by releasing the pawls of front and back rollers and moving the quilt forward. The quilt is then thrown back by the hand levers and slide pieces until the front roller comes again close to the needle to bring the next seam at the required distance from the one last made. The quilting is then continued as far as the arm of the sewing machine will admit the rolling up, which is generally one half or more of the quilt.

IMPROVED GAS BURNER.

William Bedell and Winfield S. Bedell, New York city.—This invention relates to gas burners, and the nature of the invention consists in combining a valve which has a guide stem or tail formed on it, with a square seat formed on the upper end of the lower section of a two-part burner, whereby there is a double check to the flow of gas into the upper section of the burner, and a uniform supply of gas, automatically regulated, is obtained. The lower tubular section of the burner receives the supply of gas through a suitable pipe, and is constructed with an external or male screw-threaded portion adapted to receive the upper section of the burner. A ball, which is of less diameter than the internal diameter of the gas chamber, is constructed with a cylindrical neck or guide stem, which is loosely applied inside of the male tubular portion of the lower burner section, and constructed with a flat bottom, although a slight concavity or convexity of the bottom will not be objectionable. This check valve may be made of lead, an alloy of lead and tin, or any other suitable metal. The spherical portion rests upon the angular edge of the flat top of section, and is held down by its own weight and the weight of guide stem. Gas rising through the lower section first impinges against the lower end of the stem and is uniformly spread outward. The gas then rises and is again spread outward all around the ball into the chamber. Thus we have two checks for the gas ascending through the burner, which will render the flow regular, even under varying pressures or heads.

IMPROVED FIRE ESCAPE.

George J. A. Taggart, Parsons, Kan.—This invention has relation to means for affording safe egress from the upper stories of a building which is on fire. A access is made in the wall of the building just below the sill of a window. If desired, this recess may be lined with metal, or a cast iron box may be set into the wall flush with its surface. The bottom of the recess should be inclined downward and outward, so as to form a self-discharging chute for a chain ladder. A trapdoor is hinged at the bottom of the recess, and adapted for closing the same. On the inside of the door is an angular lever bolt, the upper end of which is designed to enter a recess made in the window sill, and to hold the door fast. The lower end of the lever bolt is extended outward through a hole made through the door, and has attached to it a block or blade, arranged so that a stream of water directed upward against it from a hose will unlatch the door and allow it to be forced open. In hotels and other large buildings it is contemplated establishing communication between each one of the trapdoors used and the office either by draw wires or by galvanic battery wires, so that an alarm will be sounded in the office when a trapdoor is opened. Means may be adopted for opening and shutting all of the trapdoors of a building from one fixed point, at the same time each trapdoor may be opened by a person in the room to which the fire escape is applied. A chain ladder, which is attached to the top wall of the recess, and made of sufficient length to reach the curbstone of the sidewalk, where its lower end can be attached to hooks or rings fixed thereto. The lower end of the ladder is attached to a flanged drum or reel, on which it is wound, and put into the receptacle. When the door is opened the reel will fall and unwind.

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IMPROVED EGG CARRIER.

Martin A. Howell, Jr., Streater, Ill.—The object of this invention is to provide an improved egg crate or box which shall be adapted to contain and safely transport a larger number of eggs than those of the same size in common use, and which may withal be cheaply constructed. The racks for holding the eggs are provided with perforations and coated with glue (or other adhesive substance), and then covered with hay chaff.

IMPROVED STOVEPIPE THIMBLES.

James Carhartt, Pontiac, Mich.—The object of this invention is to provide an improved stovepipe thimble which is securely retained in the wall, readily swung into open or closed position, and so arranged as to firmly retain the stovepipe in the thimble. The invention consists of a stovepipe thimble with swinging cover and ventilator, having cam below pivot, that binds on stovepipe when inserted. The thimble has an outwardly-bent flange at the inner end that locks the thimble, in connection with the face ring or moulding, rigidly to the wall. When the cover is held in position slightly sidewise of the vertical axis, the lug and cover clear entirely the hole and admit the ready inserting of the stovepipe. The cover is then allowed to assume a pendant position, so as to throw a cam, at end of the lug, to the inside of the circumference of the face ring and cause the same to bind tightly on the stovepipe, retaining the same in firm position in the thimble. For taking out the stovepipe, the cover is swung sidewise, so that the cam releases the pipe, which is then taken out and the cover replaced by being locked to the top hook. The thimble is provided at the inner end with an outer flange that binds on the wall of the chimney, while the face ring, which is riveted to the outer end of the thimble, binds on the outer surface of the wall, so as to secure the thimble in rigid position in the stovepipe hole.

IMPROVED SLED PROPELLER.

George F. Shaver, Moorheadville, Pa.—Two bars are connected by a crossbar with front of sled, and at the upper end by another crossbar. The ends of the latter are extended to form pivots on which the propelling bars and their rigidly attached handles are journaled. It will thus be seen that if the handles are worked through the radius of the upper third of the stroke, great speed can be obtained on ice, where there is little resistance, while if the levers are worked at an obtuse angle, or in the radius of the lower third of the stroke, sufficient power is obtained to travel on a level or uphill, where considerable resistance is to be overcome.

IMPROVED MUSIC SUPPORT.

Elan A. Marsh, Battle Creek, Mich.—The object of this invention is to so construct a walking cane that it may be readily and quickly adjusted to form a convenient and substantial music stand, and *vice versa*. The improvement consists in the construction and arrangement of the supporting legs with respect to a screw plug and the hollow tubular end of the cane forming a containing case, the construction of the rack for holding the music, and the means for securing the rack to the standard.

IMPROVED BOAT-LAUNCHING APPARATUS.

Martin Bourke, Youngstown, O.—The danger incurred by launching life and other boats—more especially during the prevalence of storms or high seas—by lowering them directly alongside the ship is obvious and well known. It is the object of the patentee to avoid such danger by providing a compact but efficient apparatus for launching boats at a distance from the ship's side. This he effects by suspending the boat in a swinging frame pivoted to long bars which are pivoted to the side of the vessel and stand vertical. These bars are lowered by tackle, and the boat then detaches itself and floats free of the swinging frame. The launch may be controlled by the occupants of the boat, or by persons remaining on the vessel. The inventor proposes to use the apparatus in connection with an improved life boat, for which he has also obtained letters patent.

IMPROVED TEMPORARY BINDER.

Paren England, Lincoln, Neb.—It is an improvement in that class of files which have two leaves connected by a flexible fullness of leather, so as to permit said leaves to fold like a book. The object of the improvement is to render the backs of the file automatically adjustable to the increasing contents of the same, and to provide means for removing and preserving the contents in their indexed order. To these ends the invention consists in arranging in one of the backs of the file a spring which is connected with, and exercises a tension upon, a set of cords which run through the index and connect the two backs, and is also connected with, and exercises a tension upon, a flexible strap running to the outer edge of the back and carrying a clasp for fastening the said backs. The invention also consists in the particular construction and arrangement of the index and the file whereby the said index is made easily removable with its orderly arranged contents, so that they may be preserved in this form and a second index substituted for the same in the file.

IMPROVED TAX RECKONER.

George E. Burnett, Harrisburg, Ill.—This computator is chiefly designed for the use of assessors and collectors of taxes. It consists mainly of a cylinder adapted to rotate, and having strips attached on which are inscribed numbers representing values or assessments, also the tax rates, the amounts of the several taxes on the given values or assessments, and the aggregates of the several taxes. The strips are adjustable and detachable, being secured by screw clamps. The cylinder is rotated by a finger wheel and arrested or held by a friction brake arranged in a peculiar manner.

IMPROVED FOLDING LADDER.

Algernon S. Riches, Gleubeulah, Wis.—This invention relates to an improved folding ladder designed for easy transportation, convenient handling, and compact storage; and especially adapted, by reason of such qualities, to use in stores, shops or dwellings, where the ordinary form of ladder could not well be used. The improvements consists, first, in forming inclined recesses in the inner sides of the side rails, so as to receive the rounds when the ladder is folded, and allow the side bars to be immediately adjacent to, and flush with, each other and the rounds hidden from view, the recesses also forming supporting shoulders when the ladder is disposed for use; secondly, in slotting one of the side bars at its pivot connections with the rounds in order to permit the side bars to be arranged convergently at the top; and thirdly, in the combination with the side bars and the pivoted rounds of a locking brace for holding the ladder stiff and rigid when the same is in use.

IMPROVED FERMENTING VAT.

Christoph Klein, Brooklyn, N. Y.—This invention relates to a new construction of fermenting vat for breweries, distilleries, and similar works; and consists essentially of a vat having vertical walls, made of horizontal pieces, which are bound together by vertical bolts, the corners of the wall and bottom being connected by tongue and groove joints, and the walls firmly encircled by metallic bands or hoops, adjusted by right and left hand screw bolts. The vats may be readily manufactured and shipped in sections, being put up for use in perfectly tight manner by any one by bolting first the side pieces together, and connecting then the bottom and side walls by the outer bands. A fermenting vat of considerable strength, that is not liable to leak, and fully able to sustain the pressure of the large quantity of liquid, is thus furnished, which has the additional advantage that it takes up less room than the round vats, requiring only a small passage between two vats, and allowing, therefore, for a larger number of vats to be set up in a given space.

IMPROVED STREET CAR AWNING.

Frank P. McIntyre, Philadelphia, Pa.—The object of this invention is to provide an awning for street cars, designed to extend over the horses and protect them from the excessive and exhausting heat of summer. The invention consists in a horizontal longitudinal supporting rod arranged inor upon the top of the car, extending the whole length of the same, and a sufficient distance in front to cover the horses, which rod is hooked at its outer end, and supports a U-shaped marginal rod, the inner arms or branches of which are detachably fastened to the car, which device, together with a transverse brace, constitutes the supporting frame of the awning.

IMPROVED MANUFACTURE OF BOOTS.

Henry Sauerbier, Newark, N. J.—This invention relates to a peculiar crimp, consisting of corrugations or creases formed at the junction of the upper proper with the front of the boot leg, the object being to increase the elasticity and flexibility of the boot at that point, and thereby render it easier to the wearer as well as enable it to be easily drawn on or off the foot.

NEW AGRICULTURAL INVENTIONS.

IMPROVED DITCHING PLOW.

Seth Furnas, Bridgeport, Ind.—This invention relates to certain improvements in ditching plows, and it consists, first, in the particular construction and arrangement of a scoop-shaped plow extended upwardly and rearwardly in the form of an inclined trough, and combined with the beam and handles; and secondly, in the particular construction and arrangement of devices for supporting and adjusting the handles upon the rear extension of the trough.

IMPROVED COLTER AND PLOW STOCK.

Andrew H. Farmer, Oak Level, Va.—This colter is curved slightly forward at its point, and has a serrated cutting edge. Its back edge lies in contact with a bent stock or standard. It is therefore supported by the latter, and is also held in place by its bent arm, which enters the beam, and by lugs or ears formed on the stock itself.

IMPROVED GATE.

Rev. Lewis T. Mason, Ellington, N. Y.—The object of this invention is to provide an improved device for unlatching and opening and for closing and latching a gate in a simple and convenient manner without descending from the vehicle. To this end the invention consists in the combination with the operating levers of two gates connected for simultaneous movement, and arranged to swing the one in and the other out to open the gate way for the vehicle, the said gates being also so geared as to open a single one of the gates a short distance for persons on foot or horseback, without moving the other.

IMPROVED HORSE HAY RAKE.

Edward Huber, Marion, O.—This invention is an improvement in the class of wooden rakes which are prevented from revolving by means of spring catches attached to the front ends of the handle bars and bearing on the front teeth. The improvement relates chiefly to the construction of the device by which the two parts of the rake are pivoted together.

IMPROVED PLOW.

Julius Hartmann, Louisville, Ky.—This invention relates to certain improvements in the construction of reversible or hillside plows, more particularly those in which a double mouldboard vibrates about a horizontal pivot. The objects aimed at are to reduce the weight and cost of such plows without lessening the strength, to increase their durability, and render them easier to handle, and also of lighter draft, by reason of being so constructed as to have a center draft.

IMPROVED HARROW.

Lewis B. Coddington and William W. French, Westfield, N. J.—The object of this invention is to provide a harrow which will yield to inequalities of the ground, and which may be readily moved from place to place. The harrow bars are provided with ordinary harrow teeth, and are hinged on a rod that passes through the end pieces of the frame near its front side. The rear crossbar of the frame is supported a small distance above the end pieces by standards, and between the said bar and the harrow bars springs are placed on rods that project upward from the said bars through the bar. The center bar is arranged at right angles to the axle of the harrow, and the adjacent bars attached to it near its forward end, and extend backward diagonally in opposite directions. The bars, as well as the ends of the frame, are arranged parallel to the bars, so that bars on opposite sides of the center bar diverge. The forward side of the frame is provided with two uprights, that pass through a bar that is hinged to the axle which is supported by wheels. Springs are placed upon the uprights which press against the bar and hold the frame down. Chains are attached to the ends of the frame and are connected with a chain that runs over a pulley at the side of the tongue, and is attached to a sheave formed on the end of the lever, and pivoted to a standard that projects upward from the axle. The arrangement of the bars is such that all of the ground over which the harrow passes is operated upon by the harrow teeth, and, by means of the springs, the teeth are held to the ground with sufficient pressure for ordinary work, while they are permitted to yield to the inequalities of the surface, or to obstructions. By drawing the chains, by means of the lever, the harrow may be held to the ground with additional force.

IMPROVED CORN PLANTER.

William J. Nicholson, Paola, Kan.—The object of this invention is to furnish an improved corn planter, which shall be so constructed that the slide may be operated to drop the seed by the advance of the machine, and which shall be simple in construction and reliable in operation. To the inner side of one of the wheels that support the apparatus are attached arms or blocks, so that the distance apart of the hills may be regulated by varying the number of the said arms or blocks. As the wheel revolves, the arms or blocks strike against the teeth of a toothed wheel and revolve it. The upper end of the journal of this wheel revolves in a groove in the lower side of the axle, and its lower end revolves in a hole in a board which rests in stirrups. To the lower side of the toothed wheel is attached a cam wheel, made with several cams and which enters a recess in a plate placed upon the board, and is so made that the plate may be slid back and forth by the revolution of the cam wheel. To the sliding plate is pivoted the rear end of a lever, which is pivoted to a rod attached to the frame of the machine, and which serves as a fulcrum for the said lever. The forward end of this lever is pivoted to the dropping slide, so that the seed may be dropped by the vibration of the said lever.

IMPROVED FRUIT PICKER.

Jesse C. Stribling, Pendleton, S. C.—This invention consists in a wire frame, which is hinged to a curved wire fork attached to a pole or handle, the said frame being provided with a bag for receiving the fruit and with a cord by which it may be moved, and the fork is provided with a curved pivoted knife, that is connected by a link with the bag frame, and moves across the fork whenever the frame is moved. The manner of using the instrument is as follows: The fork is placed astride the stem which supports the fruit, and the fruit is pulled from its stem and falls into the bag attached to the frame. If it should be desirable to cut the stem, the arm is moved by the spring attached, which moves the knife sufficiently to cut the stem of the fruit. The instrument is light and portable and is inexpensive in its manufacture.

IMPROVED CHECK-ROW ATTACHMENT FOR CORN PLANTERS.

Lewis S. Woodside, Riverton, Iowa, assignor to himself and Morris S. Sober, of same place.—The object of this invention is to furnish an improved attachment for corn planters, which shall be so constructed as to enable the seed to be planted in accurate check row without its being necessary to mark the ground in anyway. The invention consists in the combination of two chains, two pairs of hinged blocks, and wheels or rollers, with the lever that operates the seed-dropping slide, and with the driving wheels and their axles. The wheels are rigidly attached to the journals of the axle, which revolves in bearings attached to the frame, and is made in two parts, coupled together at their inner ends by lugs and pins, to enable the machine to be turned around without one of the wheels having to slide upon the ground. The forward ends of the side bars of the frame project, and to their forward ends is hinged the frame, to which the tongue, runners, and seed hoppers are attached. The slide by which the seed is removed from the hoppers and dropped to the ground is provided with two dropping holes in each end, so that each end may drop a hill at each movement of the slide. Two rollers are placed upon the opposite sides of the axle, so that the dropping slide may be moved twice at each revolution of the wheels. The circumference of the wheels should be exactly equal to twice the required distance between the hills. To the rim of each of the wheels are attached two cross blocks in such positions as to mark the ground directly over each hill, to serve as guides to the driver and enable him to plant the field in accurate check rows.

IMPROVED TOBACCO AND CABBAGE PLANTER.

John C. Tennent, Aquasco P. O., Md.—The apparatus is mounted upon wheels, and two parallel plates are pivoted toward their forward parts to the side bars of the frame by a shaft. To the shaft, between the plates, is pivoted a wheel, formed of four solid arms and four hollow arms alternating with each other, and the outer ends of all of which are made wedge-shaped. The solid arms are simply designed to keep the wheel revolving by coming in contact with the ground. The hollow arms are designed to receive the plants, carry them to the ground, open holes in the ground, and drop the plants into them. To enable the arms to do this the plates that form the rear face of their wedge-shaped ends are made loose, and to the side edges, near their inner ends, are pivoted the ends of two bars. The bars cross the arms, and are pivoted to them near their forward edges and at a little distance from the inner ends of the forward inclines of their ends. The plants are inserted roots outward in the hollow arms while the said arms are upon the upper side of the wheel, and before the valves have been closed. The soil is pressed in around the roots of the plants by plates which are attached to the lower ends of the standards.

IMPROVED GRAIN TALLY, BAG HOLDER, AND WEIGHER.

Adam C. Lintz, Sweet Air, Md.—The operation of this improved apparatus is as follows: The support is adjusted on the standard to the proper height for the bags to be filled and weighed. A bag is then clasped between curved pieces. Grain is poured into the bag until the required weight is indicated by an index. The curved piece is then raised to release the bag, and at the same time the pawl is carried upward, moving a wheel one notch. The wheel makes a revolution for every fifty bags removed from the apparatus, and every revolution of the wheel is registered by a register wheel. This improvement is designed more particularly for the use of thrashers in measuring grain; but it may be employed for other purposes.

IMPROVED SULKY STALK CUTTER.

Micheal E. Roach, Rolling Prairie, Ind.—The object of this invention is to furnish an improved machine for cutting corn stalks into pieces in the field, so that they may be turned under by the plow, and will not impede or clog it, and which shall be simple in construction, convenient and effective in use, and may be readily drawn from place to place. The cutting plates are inserted in radial slots in the wheels, and are secured in place by pins passed through their inner corners beneath shoulders formed upon the outer sides of said wheels, so that they may be readily detached to be sharpened. To the opposite sides of the tongue are pivoted the upper ends of two rods, the lower ends of which drag upon the ground, and have hooks formed upon them to straighten the stalks, so that they will be cut by the cutter. As the tendency of the draft is to tilt the cutter frame forward, which tendency is resisted by the draft of the sulky, and is made to press the cutters into the ground. The machine is adjusted for being drawn from place to place by detaching the reach and running the sulky forward until the rear crossbar can be raised and hooked upon the hooks. The forward end of the reach is then placed upon the rear end of the tongue, and the lower arm of the U-bolt is passed through the socket and tongue, and its upper arm is passed above the reach, so as to make the tongue rigid and secure the reach at the same time.

IMPROVED APPARATUS FOR BENDING AND TEMPERING MOULDBOARDS.

Dan Franklin, Tama, Iowa.—The hot mouldboard receives its intended form between dies, its position between them, by which its "twist" is determined, being governed by the position of guide pins which are set in the lower die and enter the bolt holes of the mouldboard. The guide pins may be interchanged to vary such position, or set in new holes, as required. When the mouldboard has been shaped by the dies it is removed therefrom (while still redhot), and quickly clamped in a two-part tempering form, through which water or other tempering mixture is then forced under pressure. The form preserves or restores the curvature previously imparted by the dies, and the mouldboard is tempered in the desired manner. It will, therefore, when removed from the form, retain the exact shape desired, so that it may be applied to a plow frame without the labor, delay, and expense ordinarily attending such operation.

IMPROVED CHURN.

Jacob Weider and John S. Weider, Burlington, Iowa.—This invention relates to rotary churns, and it consists mainly in a dasher of peculiar form, in which fingers projecting downward from a horizontal centrally pivoted bar are employed to stir the cream and to break the oil globules. The cover is made in two parts. The smaller one is provided with a window, and may be removed without disturbing the gearing. The larger part supports the gearing, and may be removed when the churn is cleaned. Both parts are provided with pins that project over the edge of the cover and engage eyes attached to the body of the churn. An aperture for drawing off the milk is made in the side of the churn just above the bottom, and a spout is placed below it. In this improved churn the cream is thoroughly acted upon by the fingers as they are rotated by means of the gearing, so that the greatest possible percentage of butter is produced. By observing the condition of the cream as it is thrown against the window the progress of the churning may be known. After churning, the butter may be washed and worked without removing it from the churn.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED THILL COUPLING.

Alonzo Gandy and Henry W. Wilson, Freeport, O.—This invention relates to an improved thill coupling that admits the ready removing and replacing of the shafts, and also the support of the same in raised position, which forms an important feature of this thill coupling, the same combining, furthermore, neatness, lightness, and durability. The invention consists of parallel supports or lugs of the axle clip, of which one support has an eye and extension recess or notch; the other a rigid pivot pin, extending centrally into the eye, and carrying the sleeve attached to the shaft end. The sleeve has a shoulder and fits into the eye, turning on the pivot when inserted into the supporting plates. By allowing the shoulder to rest in the notch the thill is supported in raised position, which forms a very convenient feature of the same, as the shafts may be retained in raised position, and lowered when the horse or horses are harnessed. By pushing the sleeve in so that the shoulder is between the supporting plates, the shaft may be lowered, and is thereby securely coupled. The sleeve turns in the eye around the pivot, which facilitates the coupling, while the front part of the recessed support secures the desired resistance to the draft. The shafts are, by the use of this coupling, easily coupled and uncoupled, and also spuported in raised poitions when required.

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Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion.

Engineer.—Situation wanted to run a Stationary Engine. Address C. Wiggin, Poughkeepsie, N. Y.

Book on Making and Working Batteries, Electrotyping, Plating, etc., 25 cts. T. Ray, Box 356, Ipswich, Mass.

Hay Cutters, Corn Shellers, Powers, Cider Mills, etc. Everything for the farm. 200 illustrations latest improvements mailed on receipt of 10 cents. A. B. Cohu, 197 Water St., N. Y.

Scroll Saws. Stero. Photo., 10 cts. W. E. Lewis, Cleveland, O.

Wanted.—A Boring and Slotting Machine for heavy work. Address Chas. A. Martin, 81 Fourth Ave., Pittsburgh, Pa.

New and second-hand machinery taken in store and sold on commission. Consignments solicited. Schenck's Machinery Department, 36 Liberty St., N. Y.

Wanted—A partner to buy half interest in a Plow and Repair Shop. Address M. A. Conley, Perry, Iowa.

A great many families from the South and West, on their homeward way from the Eastern summer resorts, spend a few days in the city for the purpose of selecting Winter Outfits for the boys. Baldwin the Clothier is the popular name in all households.

Plumbers—Address Bailey, Farrell & Co., Pittsburgh, Pa., for the best and cheapest iron case street hydrants.

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Magic Lanterns and Stereopticons of all prices. Views illustrating every subject for public exhibitions. Profitable business for a man with a small capital. Also lanterns for college and home amusement. 74 page catalogue free. McAllister, Mf. Optician, 49 Nassau St., N. Y.

"Little All Right," the smallest and most perfect Revolver in the world. Radically new both in principle and operation. Send for circular. All Right Firearm's Co., Lawrence, Mass., U. S. A.

For Solid Wrought Iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

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John T. Noye & Son, Buffalo, N. Y., are Manufacturers of Burr Mill Stones and Flour Mill Machinery of all kinds, and dealers in Dufour & Co.'s Bolting Cloth. Send for large illustrated catalogue.

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For Best Presses, Dies, and Fruit Can Tools, Bliss & Williams, cor. of Plymouth and Jay Sts., Brooklyn, N. Y.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing metals. E. Lyon & Co., 470 Grand St., N. Y.

Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, N. Y.

Steel Castings from one lb. to five thousand lbs. Invaluable for strength and durability. Circulars free. Pittsburgh Steel Casting Co., Pittsburgh, Pa.

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For Boult's Paneling, Moulding, and Dovetailing Machine, and other wood-working machinery, address B. C. Machinery Co., Battle Creek, Mich.

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Chester Steel Castings Co. make castings for heavy gearing, and Hydraulic Cylinders where great strength is required. See their advertisement, page 190.

Reliable information given on all subjects relating to Mechanics, Hydraulics, Pneumatics, Steam Engines, and Boilers, by A. F. Nagle, M.E., Providence, R. I.

Notes & Queries

(1) J. B. asks how to make resin more elastic, that is, overcome the brittleness, without making it expensive? A. Try fusing it with a little oil.

(2) C. B. R. asks for the process of making carbons for battery? A. The fine dust of coke and coking coal is first put into a close iron mould of the shape required for the carbon, and exposed to the heat of the furnace. When taken out, the burned mass is porous and unfit for use, but by repeatedly soaking it in thick sirup of gas tar and heating it, it at length acquires the necessary solidity and conducting power.

(3) C. J. H. asks if the Colorado or potato beetle or bug is the same as the "*cantharis vittata*" or potato fly? A. No. 2. Has the Colorado beetle similar properties to the cantharides? A. No.

(4) W. A. P. says: I wish a recipe for keeping cider sweet otherwise than boiling? A. Add to it salicylic acid—about 15 grains to the gallon.

(5) C. R., Appingedam, Holland, asks how lard oil is made? A. Lard oil is chiefly obtained as a secondary product in the manufacture of stearin. It is purified first by agitation with sulphuric acid, and afterwards by steaming it and washing it with water.

(6) T. A. asks: What is the value of sawed pine shingles, as regards durability, when compared with sawed cedar? A. Under ordinary circumstances, cedar shingles are at least 100 per cent more durable than pine.

(7) C. W. B. says that an ounce of alum, added to a pint of flour paste when making it, is an effectual and harmless remedy to preserve it, even during very warm weather.

(8) W. H. H. says: I have a porch laid of pine floor-boards, and had it painted. The heat of the sun has drawn out the pitch or turpentine in large quantities, making it almost unfit for use. Is there any way to remedy the difficulty without taking up the boards? A. Scrape off the pitch and cover the bad places with a coat of shellac varnish, then paint it over again.

(9) A. L. D. M says: We are troubled in this country with cotton worms, and to prevent their destroying our crops we are compelled to resort to poison. Arsenic proves to be the best remedy yet introduced, but a great many people are afraid it will make the land sterile. Some say it is a fertilizer, while others say it is a sterilizer. A. We do not find that, as usually applied, it has any notable effect in either direction. It would not in any case tend to sterilize the land, unless, perhaps, applied in great excess. In some cases it would doubtless prove beneficial in aiding the plant assimilation, but we would not counsel its use except in cases of necessity—for destruction of insects, etc.

(10) H. C. B. asks: Can india rubber be restored to its original elasticity, which has become hard by several years' exposure to a warm atmosphere? A. No.

Has steam or compressed air power been applied to private carriages? A. Steam has been successfully used. Compressed air has been tried and found inconvenient, owing to the large size of the air chambers required.

(11) M. B. asks how chromo-enameled iron show cards are made? A. They are prepared by dipping the hot metal in the paper pulp, or *papier maché* passing through a bath of alum solution and then through one of soap, alum sized, and hotpressed in the usual manner.

(12) J. M.—Trymethylamine is produced by heating under pressure, in enameled iron vessels, rosaniline, an alcoholic solution of soda or potassa and iodide of methyl.

(13) C. M. says: Not long ago I dug up a few shells from a blue clay bank which were quite soft. After allowing them to dry thoroughly in the sun, I gave them a coat of shellac varnish. They now seem to be covered with a white mould. How can I remove it without injuring the shells, as they are valuable fossils? A. It may be impurities in the varnish, moisture in the shell, or improper mode of varnishing. You can probably remove it with strong, hot alcohol. The varnish should have been made very thin with alcohol, and applied by dipping.

(14) J. H. N. asks how to clean the glass tubes of a fountain which have become muddy on the inside by the deposit of water passing slowly through them? A. It would be better to remove the tubes, if possible, and agitate in them a little water mixed with fine shot, as the dirt would resist most solvents.

(15) C. M. H. says: Please inform me of some recipe for removing superfluous hair? A. Make a strong solution of sulphuret of barium into a paste with powdered starch. Apply immediately after being mixed and allow to remain for ten or fifteen minutes.

(16) E. H. R. asks: Is the following a good recipe for making a good ink, and will it retain its color on books: Copperas ¼ lb., brown sugar ¼ lb., gum arabic ¼ lb., powdered nutgalls ¾ lb., rain water 2 gallons? A. Use less sugar and about a third less water. This will afford an excellent black ink if properly made.

(17) B. B. asks: What cement can I put on a leaky piazza roof to make it tight? A. Take 4 lbs. rosin, 1 pint linseed oil, 2 ozs. red lead, stir in fine sand until the proper consistency is secured, and apply warm. This cement becomes hard, and yet possesses considerable elasticity, is durable and waterproof.

(18) C. F. says: I have a lot of books and papers, bound and unbound, into which bedbugs have got. How can I exterminate them? A. A liberal application of insect powder will no doubt prove effectual or place the papers on a rack in a large close box, and on the bottom of the box place a dish in which burn a small quantity of brimstone.

(19) W. N. R. asks for the solution used for etching on steel and brass? A. For steel, iodine 1 oz., iron filings ½ drachm, water 4 ozs. Digest till the iron is dissolved. For brass, aqua fortis 2 ozs., water 5 ozs.

Is oil of vitriol injurious to leather when used in blacking? A. The amount used is too small to seriously injure the leather.

(20) P. R. H. and C. & Son ask for a japan that will give a good hard black finish on wood? A. Use common black baking japan, to be obtained of the varnish dealers, and when thickly coated on the work bake or dry in an oven or kiln the same as when this japan is put on iron or metal work.

(21) M. C. M. asks: Why is it that a small steam boiler will carry more pressure than a large one? A. Because it is generally stronger.

What simple rule is there for finding the relative value of dollars and pounds sterling? A. Multiply the amount in pounds sterling by 4·83, and the answer is in dollars. Divide dollars by this amount and the result will be pounds sterling. For accurate reduction the rate of foreign exchange and premium on gold over United States currency must be allowed for, for which see early financial quotations in the newspapers.

What is carbolic acid, and how is it made? A. It is a product of coal tar, obtained by distillation.

What is the best filtering material to put in a small house filter for drinking purposes? A. A sponge answers very well.

(22) G. T. says: We have put up peaches and other fruit in cans which were sealed by soldering. After a few days most of the cans burst open. What was the reason of their bursting? A. The rupture of the cans may have been due either to the fermentation of the fruit, or by the formation of a partial vacuum within through contraction of contained vapor and air on cooling.

(23) W. P. M. says: 1. What length and number of cotton-covered wire shall I use to cover the armature of an electromotor with? A. You may use about 150 feet of No. 16 covered wire. 2. If, after winding one core, shall I continue the wire to the next arm and coil it, or make six separate coils? A. It is better to make separate coils. 3. Is it necessary that the circuit breaker should be insulated from the shaft which is in metallic contact with the magnet cores? Will such an engine, with 10 Grove cells, run a sewing machine? A. Yes.

(24) B. V. H. asks: What can I add to common plaster to make it set quick and hard and be very brittle? A. There is nothing possessed of all these requisite properties. Perhaps soluble alkaline silicates (water glass) may answer your purpose. Plaster made up with alum water instead of water alone, sets very hard, but not quickly.

(25) E. F. asks how to fasten photographs on glass without leaving air bubbles and not have them cleave off? Also how to make them transparent? A. If you refer to a photograph on paper, smooth and dry it perfectly, and coat the face uniformly with a thin balsam. Warm the plate and curl on the paper, letting the middle touch first, and immediately bring down the ends. Or attach one end of the paper and pass a small roller over it so as to place it in smooth contact at one motion. Finally, give the back of the picture a smooth flowing coat of good negative varnish.

How was the bread made that was used at the "dairy" on the Centennial ground? The loaves were about 2 feet long and 3 or 4 inches in diameter. A. See p. 240, vol. 34, of SCIENTIFIC AMERICAN.

(26) J. H. R. says, in answer to W. E. S., paragraph (18): The fulcrum is below the water line, and more or less near it as the ship has less or more ballast. If she is heavily ballasted and unladen the fulcrum will be near the bottom. If her load is near the water line and she has no ballast, the fulcrum will be near the water line.

(27) Subscriber asks: What ought to be the weight of a balance wheel for a foot lathe to turn wood? A. From 80 to 100 lbs.

(28) A. G. W. asks: Would it not be better to ventilate a stable from the top by extending a tube from the ceiling to the peak of the barn for the foul air to escape? Extend another one from some cold room or hayloft above down to within about one foot of the stable floor. Through this second tube the cold air will descend, as, being heavier than the warmer foul air of the stable, it will take the lowest place, and drive the bad air up through the first tube. A. If the room above, from which the fresh air is to be drawn, is tight, the air cannot be supplied from it to a sufficient extent. The varying pressure of the atmosphere, arising from the winds and from barometric changes, would provide a more efficient ventilation in this case, which could be tempered and graduated as experience should dictate; the openings could be provided with graduated registers, or fixed blinds outside of sliding shutters.

(29) B. S. says: I want to paint the joints of some brickwork black. I would like to know what is mixed with the mortar in preparing it for use? A. Coal dust and English drop black are used for coloring. Prepare the mortar and mix in the color until black enough to suit.

(30) Novice, London, Canada, asks how to lay a tile pavement? A. Make a bed for the pavement of broken stones pounded together, over which spread a layer of cement. When dry, spread over this a layer of cement in which the tiles are carefully set.

(31) J. G., of Montreal, asks for a recipe to stiffen felt hats, and how prepared? A. Mix 18 lbs. of shellac with 1½ lbs. salt of tartar (carbonate of potash) and 5½ gallons of water. Put in a kettle and boil gradually until the shellac is dissolved, when the liquid will be clear as water. When cold dip the hats, and when nearly dry dip in a weak solution of acetic or sulphuric acid in order to neutralize the potash and cause the shellac to set.

(32) D. B. H. asks: Does it require battery power to work a telephone on a short line, say half a mile? A. No battery is required. The telephone contains a small electrical device on which the force of the voice acts and produces an electrical current.

(33) C. M. K. asks if there is any difference in testing gas pipe with a mercury gauge, whether mercury or water be used in the gauge? A. Water can be used, but mercury is ordinarily more convenient in the case of an open gauge.

(34) T. P. B. says he has a lot of 1 inch steam pipe, and a four horse engine, and wishes to use the pipe in some way to make steam to run the engine? A. We know of no practical way to use pipe so small to make a serviceable boiler or steam generator.

(35) C. H. W. says: I want a method to prevent scale forming upon polished steel and iron while heating? A. If your steel is sufficiently heated it will scale when exposed to the air. If you wish to merely soften the work, you may prevent scaling by heating it enclosed in a box or tube filled with steel turnings, luting the box or tube with clay, and allowing the steel to cool before removing it.

(36) D. F. asks for information on bleaching hair, human or yak hair? A. Gaseous chlorine is the most effectual agent in bleaching. Clean the hair with a warm solution of soda, and wash thoroughly with warm water. While the hair is moist, put in an earthen jar and introduce the chlorine until the jar is filled with the greenish gas. Allow to stand for twenty-four hours and repeat the operation if necessary,

(37) B. B. O. says: The waste pipe from my bathtub, located on the second floor, leads down to the basement, where it unites with the waste from the kitchen sink, and both pass out together into a terra cotta pipe, which after running some thirty feet from the house empties itself into a blind ditch about 2 feet or more below the surface. The ditch is made of stones laid in the bottom of the trench to a depth of 8 inches, then comes a layer of rye straw, and on top the earth. A rain spout leads into the terra cotta pipe, and both waste pipes are trapped before they unite. Is the arrangement a safe one against the escape of noxious gases? A. An accumulation of sediment is likely to take place at the blind ditch. It would be advisable to provide a large cesspool there with a movable cover below frost, and so built as to trap and overflow into the ditch—this can be conveniently cleaned out when necessary. The rain water pipe should act as a sufficient ventilator to your drain pipe.

(38) D. C. W. asks for a recipe for the varnish or lacquer which is used on gun barrels? A. Dissolve 1 oz. of shellac and 2 drachms of dragon's blood in 1 quart of alcohol. Filter through blotting paper and keep closely corked in a bottle. When put upon the barrel, and after becoming perfectly dry, rub with a burnisher to make it firm and glossy.

(39) J. J. R. R. asks: What is the greatest pressure per square inch that can be applied to a steel pivot or step turning on a steel surface or bearing, without destroying lubrication? A. About 2,200 lbs. 2. Does friction in turning or sliding surfaces increase with the pressure, and what is the ratio of increase of friction to increase of pressure? A. Some of the latest experiments are described on p. 1200 of the SCIENTIFIC AMERICAN SUPPLEMENT.

(40) F. E. P. says: I have an engine cylinder 2 x 4 inches, also a boiler shell 14 x 24 inches. Will the shell furnish steam for my cylinder? The shell is of ¼ inch iron heavily riveted. Can I with safety put in cast heads? How many 1½ inch gas pipe flues will I need in said boiler, using it as an upright boiler? A. It will be better to use wrought iron heads. Place the tubes from 2½ to 3 inches between centers.

(41) A. I. P. says: We use a band saw for sawing cane seat chair bottoms. The lumber is seasoned hard wood 1¼ inches thick. The shaft makes 475 revolutions. The saw pulleys are iron, leather covered, 30 inches diameter. Saw frame all iron. Sometimes the saws break five times a day, at other times they will run two or three days without breaking. We have tried ½ inch, ⅝ and ¾ inch saws of different makes, but with no better results. A. Sudden changes in the speed of the saw, or great variations in the quality of the timber, is probably the cause of the breakages.

(42) C. K. W. says: I have a small music box in which there are small bristles on the under side of the comb to stop the vibration of the same before it is reached by another tooth on the cylinder. What kind of cement can I use to make these bristles stick to the steel comb? A. You can attach them with shellac varnish.

(43) W. F. M. asks: How are chromos mounted? A. It is generally more convenient to attach the cloth to the frame after the picture is mounted. First stretch the cloth tightly on a board, securing it by tacks. Use common flour paste, and saturate the cloth with it. Cover the back of the chromo with paste, and apply it to the cloth, a little at a time, laying it smooth by gentle pressure.

(44) A. F. B. says: Would it be practicable to run a set of wheels and pinions with a weight, as follows: Five wheels of 6 inches diameter, gearing into 4 pinions of ⅛ the diameter of the wheels, and the fifth 6 inch wheel gearing into a 3 inch wheel, which would thus revolve 2,592 times for each revolution of the first 6 inch wheel? By applying a weight for motor to this first 6 inch wheel, of 400 lbs., what power would I have left for work? A. The loss from friction will depend upon the accuracy of workmanship. With nicely cut gear you may get an efficiency of from 60 to 70 per cent of the applied power.

(45) F. L. S. says: A friend makes the statement that the English Government has a gun capable of throwing a projectile from Dover to Calais. 1. What is the distance in a direct line between the cities? A. Twenty-six miles. 2. What is the greatest distance yet attained by any gun in throwing its projectile? A. About 6 miles.

(46) W. L. F. asks: 1. What is the proper breadth of beam and depth of a boat 16 feet long, clinker built? A. Beam 4 feet and depth 18 inches. 2. How high above the boiler will I have to place a cistern to overcome a pressure of 40 lbs. in order to feed the same by hydraulic pressure? A. About 93 feet.

(47) W. S. says: Supposing a locomotive engine, having one side unconnected, and the crank on the other side at right angles to the dead centers, and at the nearest point to the rails; when steam is admitted into the cylinder, why does the engine go forward when the force is applied in a backward direction? A. Because the rail cannot move backward.

(48) L. M. S. says: How can I make a preparation something like varnish, to dip pencil drawings in to give them a fine appearance and to preserve the paper? A. Dissolve 6 ozs. Canada balsam and 6 ozs. white resin in 1 quart of oil of turpentine.

(49) F. W. K. asks: I have a room 80x30 by 9 feet high, and wish to know about how much pipe it will require to heat it properly? A. The amount of radiating surface depends upon the character of building, number and size of windows, etc. Such a room as you speak of would need under ordinary circumstances from 150 to 175 square feet of radiating surface.

(50) K. Bros. say: Suppose there are 3 cast iron shafts 14 feet long and 8 inches diameter, one having a hole of 6 inches through the middle, the other be-

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ing cast solid metal throughout, and the third having a wrought iron shaft 4 inches in diameter cast in the middle the whole length of the shaft: which of the three will stand the greatest weight in the middle, if the shafts are suspended at both ends? A. The third.

(51) C. W. W. asks for a white fusible alloy that will take a fine impression when cast in plaster of Paris moulds? A. Lead 9 parts, antimony 2 parts, bismuth 1 part. This alloy expands as it cools and brings out a fine impression.

(52) G. N. asks for a process by which brass can be kept a bright color? A. In ½ pint of best alcohol dissolve ½ lb. of best seed lac. Warm the work and apply the dissolved lac, with a soft fine brush.

(53) C. L. asks how the process of enameling or glazing is done on cast iron? A. The enamel is made of powdered flints, ground with calcined borax, fine clay, and a little felspar. The mixture is made into a paste with water and brushed over the metal to be glazed, which has been previously cleaned and made bright with dilute sulphuric acid, and washed clean. While the glaze is still moist it is dusted over a mixture of felspar, carbonate of sodium, borax, and a little oxide of tin. The glaze is gradually dried and then fused in a muffle at a red heat.

(54) F. W. W. asks: Can you give me a recipe for making white ink, to write on a black or blue surface? A. With some papers an aqueous solution of bleaching powder with a little gum will answer. A solution of oxalic acid thickened somewhat with filtered dextrin solution has also been used. Or use a solution of gum arabic and sugar in water, through which has been diffused finest precipitated chalk or ground starch.

(55) N. H. says: I bought a piece of corned beef and cooked it. The following night I opened the refrigerator in the dark and the beef lighted up with a phosphorescent light. What was the cause and is the meat healthy to eat? A. The phosphorescence noted was very probably due to the saccharine matter or salts used in curing the meat. A change of temperature, which induces crystalization in solutions of these, often gives rise to the phenomena, after removal from strong light. The meat may be fit to eat.

(56) Mrs. G. W. L. asks for a recipe for canning green corn so it will keep? A. Among fruits, etc., green corn is one of the most difficult to preserve by canning. The following is the method in use by many of the large canning establishments. The corn, after removing from the cob, is filled into the clean cans so as to leave no air spaces. These are placed in a large oven or other airtight vessel, and subjected to hot steam under pressure. The harder the corn the longer the exposure required to thus cure it; it is said that in some cases as much as eight hours is requisite, but usually much less than this. A large vessel of boiling water, in which the cans are immersed, may be used instead of the steam oven, but is not so effective. On removal from the oven or water bath, as the case may be, each can (they must be filled to the cover with fruit) has the cap with a very small hole tapped in its center immediately soldered on. As soon thereafter as the can stops blowing, as the escape of steam and air through the vent is termed, the hole is quickly soldered. This must be done before the air begins to enter. Other fruit is cured and canned in like manner—tomatoes rarely require longer than 15 to 20 minutes steam curing. Where the pits are left in fruit a longer time is requisite to completely destroy all fermentative germs.

(57) J. F. C. asks, 1, for a quick process of bleaching cotton thread? A. In practice the following is found one of the best: The cotton is banked for 8 hours in a lye made from 6½ lbs. soda crystals and 2 lbs. 3 ozs. quicklime. After washing out it is passed into a chloride of lime (bleaching powder) solution for two hours, and then at once into weak sulphuric acid for 20 minutes. Use 11 lbs. chloride of lime and 23 fluid ozs. sulphuric acid. These quantities are for 220 lbs. of cotton. The cotton is then washed in running water, and taken once or twice through a hand-warm soap beck, using for the above weight 2 lbs. 3 ozs. palm oil soap. 2. Is there more power in the same quantity of water after night than there is in daytime? A. No.

(58) J. H. D. S., in giving an account of a table knife that was left for a few days in the remains of a water melon, and found nearly eaten up or consumed, asks what acid there is in the melon to cause this? A. Carbonic, and the various vegetable and organic acids rapidly corrode iron or steel in the presence of air and moisture. In substance, over 89 per cent of the common, well-ripened water melon consists of water. In summer weather the decay of broken melon, when once begun, is very rapid, and is accompanied by the formation of carbonic, acetic, and other peculiar organic acids. Under such favorable conditions it is not surprising that the knife was eaten by the melon.

(59) F. W. S., of Toronto, asks how to make a buff wheel for polishing steel? A. Turn up the wooden disk to form the wheel on the mandril on which it is to run. Cover the periphery of the wheel with good glue, prepared as for gluing wood, stretch the leather around and confine it with shoe pegs driven in about two inches apart. When dry turn off true with a sharp chisel. Give the leather a coat of glue and roll it in the emery, so as to make it retain it by being imbedded in the glue. Set the wheel dry until the glue is hard and it is ready for use.

(60) M. D. asks: 1. If limestone was put into a retort, what would be the gas that would pass off if heated red hot? A. Carbonic anhydride, often called carbonic acid; a gas composed of 12 parts carbon and 32 parts oxygen (by weight) in a state of combination. 2. Could one bushel of lime be so prepared as to absorb all of the carbon gas in three bushels of lime? A. No. 3. Would the carbon improve the cementing quality of the lime? A. No. It would have the opposite effect. 4. If charcoal was put into a retort and heated to a red heat, would it give off one quarter as much carbon gas as it would if it was wholly consumed? A. Freshly and thoroughly carbonized charcoal, if heated in a retort, would not yield a notable quantity of gas unless supplied with air, oxygen, steam, etc. With a plentiful supply of the former, carbonic acid would result; with air the same, but mixed with nitrogen; with steam the principal product would be carbonic acid, hydrogen, and carbonic oxide—the latter gas is very poisonous and inflammable. The amount of gas would be directly proportional to the quantity of charcoal burned. 5. If charcoal was heated red hot and then cooled off, would it regain its carbon gas from the atmosphere? A. Charcoal is capable of absorbing about 35 times its bulk of carbonic acid. This it gives out on heating, and on cooling may absorb again. 6. Is not carbon gas heavier than the air? A. Yes, about half as heavy again. 7. What acids will dissolve carbon? A. It is insoluble in acids, but is oxidized by nitric acid. 8. Will not water boil quicker in a copper dish than in an iron dish, other things being equal? A. Yes, a little.

(61) F. P. asks how to make a faradic battery? A. For faradic currents you will require a small induction coil in addition to the batteries you mention, which are constructed on the correct principle. To make an induction coil, wrap a thick cylindrical penholder back and forth—after the manner of spooled thread—with about a hundred feet of good copper wire, a fifth the size of telegraph line wire, and insulated by winding with silk or cotton. Wrap tightly around this coil a sheet of thin oiled paper, and over this bind, in a manner as before, five hundred or more feet of the finest insulated copper wire obtainable. Then force out the penholder, being careful not to tear the insulation of the wire, and fill its place with a bundle of soft iron wires. Connect the battery wires (one from the zinc and the other from the copper) with the free ends of the thick wire in the coil; then, on making or breaking the battery circuit, temporary induced currents will be caused in the fine wire, and may be utilized by attaching wet sponges to the free ends of the wire and permitting them to come simultaneously in contact with the body while the instrument is working. The batteries must be excited with weak sulphuric acid. A simple interrupter for the primary circuit is a file attached to one end of the coil wire, while the free end (from the battery) is rasped over the rough part of the file. The withdrawal, more or less, of the soft wire core diminishes proportionately the intensity of the secondary currents.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

L. F.—It is gypsum—a calcium sulphate.—J. M. F.—It is a variety of bituminous coal, yielding considerable ash. The freshly mined shale may be of some value for fuel and gas making.—J. W. E.—Your minerals do not come to hand. Send another specimen.—C. T.—It is mispickle, or arsenical pyrites—a combination of sulphur, iron, and arsenic.—We have a number of packages of minerals, etc., without mark to designate the senders.

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On the Sea. By D. G. E.

On Engines and Boilers of Screw Tug Boats. By D. L.

On Reforms. By R. H. L.

On Whence Came our Dry Land. By A. B.

On a Combat between a Squirrel and a Snake. By I. E. E.

On the Formation of a Sea in Sahara. By T. M. M.

On Rafts Floating Faster than the Current, etc. By W. M.

On Looking Backward Forty Years. By ——.

On Much Needed Postal Conveniences. By W. J. McG.

On Experience for Sixty Years. By ——.

On Employment of Capital. By ——.

Also inquiries and answers from the following:

O. H. S.—F. H. B.—J. F.—J. B.—E. H.—M. A. L.—J. W. D,—W. S.—T. T. P.—C. H. L.—A. K. & Co.—C. P.—T. W. S.—C. B.—C. H. M.

HINTS TO CORRESPONDENTS.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Inquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of inquiries analogous to the following are sent: "Who makes small engines suitable for running sewing machines? Who makes and sells wire rope? Who sells suitable instruction books for stationary engineers?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

OFFICIAL.

INDEX OF INVENTIONS

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AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list including both the specifications and drawings, will be furnished from this office for one dollar. In ordering, please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

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10,146.—PATTERN IN SUITINGS.—N. Frye, Andover, Mass.
10,147.—HANDLES OF SPOONS AND TABLE CUTLERY.—G. Gill *et al.*, Derby, Conn.
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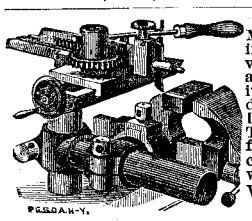

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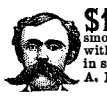

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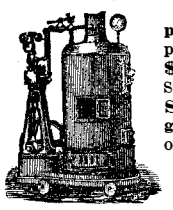

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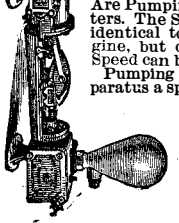

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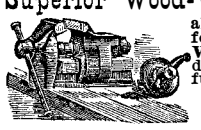

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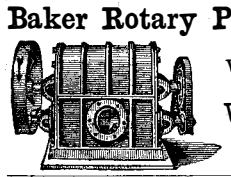

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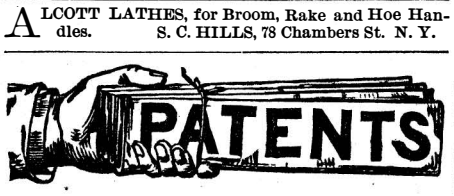

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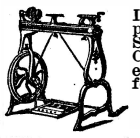

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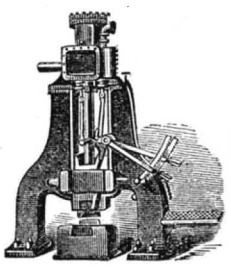

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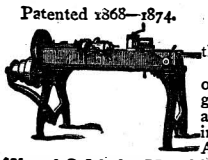

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